# SCIENTIFIC AMERICAN

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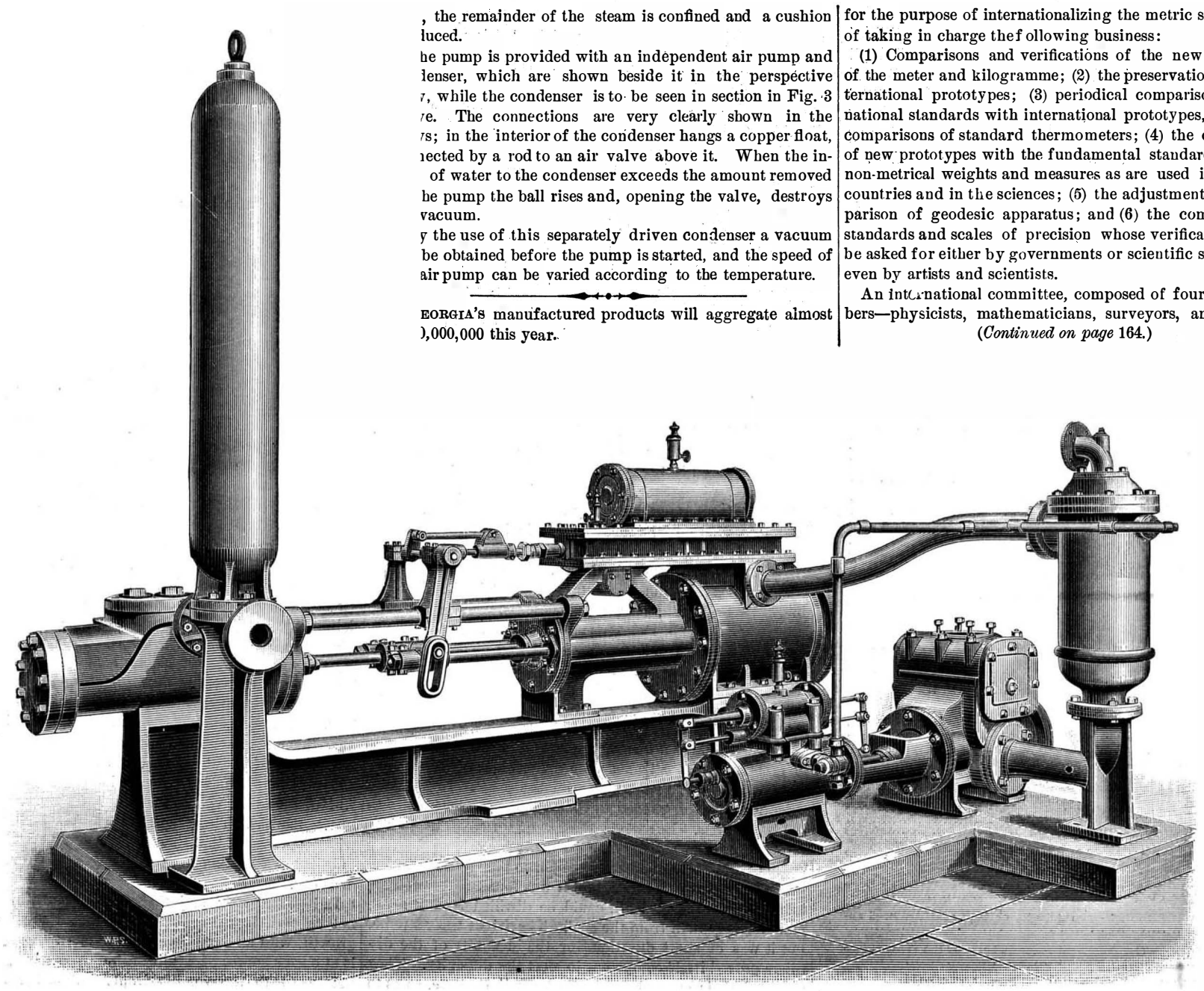
## BLAKE'S COMPOUND STEAM PUMPS.

We illustrate one of Blake's compound high and low pressure steam pumps, manufactured by Messrs. S. Owens & Co., of White Friars Street, London, E. C. It has been constructed for the Southwestern Railway Company of Russia, and is capable of forcing 4,500 gallons of water per hour to a height of 500 feet through 10,000 feet of piping, with a boiler pressure of 80 pounds to the square inch. Our cuts and description are from *Engineering*. As will be seen from the perspective view below, the two steam cylinders are arranged tandem wise, their diameters being 8 inches and 16 inches respectively, while their stroke is 24 inches. The low pressure cylinder has two piston rods, which pass through long passages cast on each side of the high pressure cylinder, so that all the glands are close together. The three rods take hold of a common crosshead to which the piston rod of the pump cylinder is connected. This cylinder is 5½ inches in diameter and is brass lined. Its valves are of gun metal and have spindles projecting upward and working in heavy gun metal caps, each of which contains a spring. The valves are faced with the best oil dressed hydraulic leather secured by a central screw, and they bear on flat faces five-eighths of an inch wide. The steam valves are operated from the crosshead through a rock shaft worked by a vibrating arm. Upon the rock shaft is a lever, which by means of a connecting rod moves a sliding block backward and forward between two tappets on the rod of the auxiliary valve. The office of this valve, as is well understood, is to control the admission and exhaustion of steam to and from the double pistons above it, which move the two main valves of the steam cylinders. The steam from the boiler is admitted to the interior of the valve of the high pressure cylinder, and after expansion it exhausts into the valve box and proceeds to the larger cylinder, which has an ordinary D valve. The piston, which is shown nearly at the end of its stroke toward the right, is prevented from striking the covers by the use of supplementary exhaust passages, which can be more or less throttled at will. When the piston has covered the main exhaust



COMPOUND BLAKE STEAM PUMP WITH CONDENSER.

, the remainder of the steam is confined and a cushion luced.

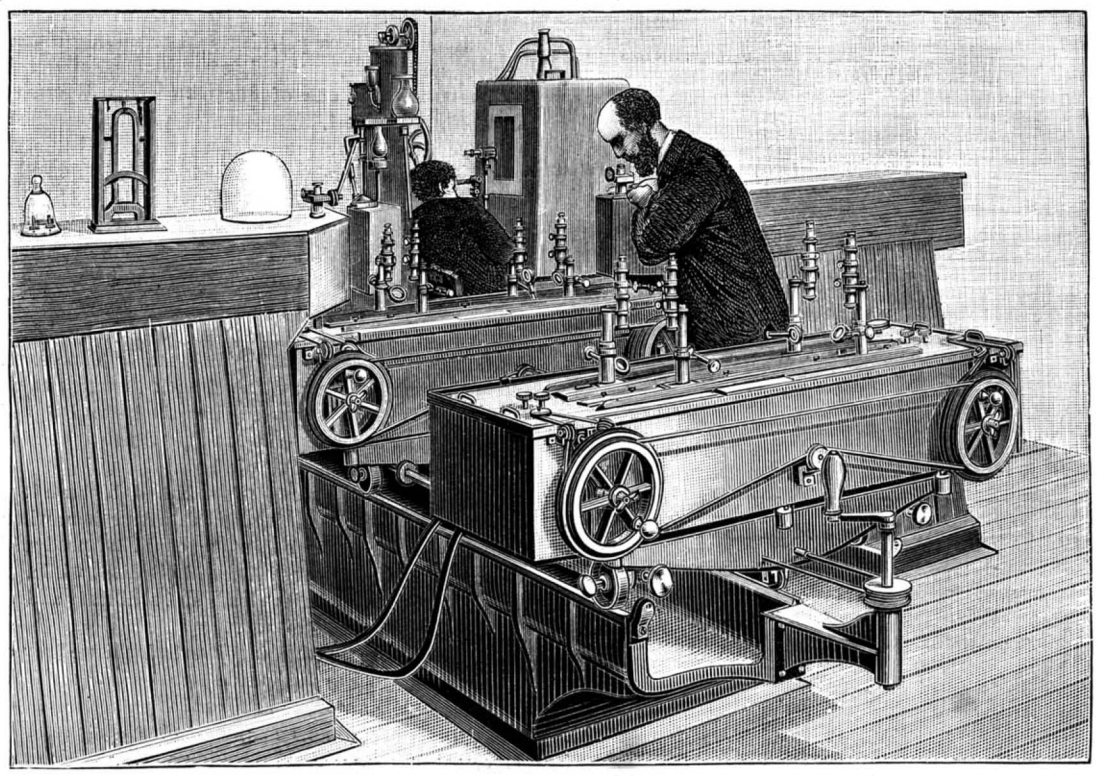
he pump is provided with an independent air pump and lenser, which are shown beside it in the perspective r, while the condenser is to be seen in section in Fig. 3 re. The connections are very clearly shown in the rs; in the interior of the condenser hangs a copper float, nected by a rod to an air valve above it. When the in- of water to the condenser exceeds the amount removed he pump the ball rises and, opening the valve, destroys vacuum.

y the use of this separately driven condenser a vacuum be obtained before the pump is started, and the speed of air pump can be varied according to the temperature.

EORGIA'S manufactured products will aggregate almost ),000,000 this year.

## THE OBSERVATORY OF THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

As a consequence of an international convention held on the 20th of May, 1875, there has been created at Paris, says *La Nature*, an international bureau of weights and measures



INSTRUMENTS FOR MEASURING EXPANSION.—INTERNATIONAL OBSERVATORY FOR WEIGHTS AND MEASURES.

for the purpose of internationalizing the metric system, and of taking in charge thef ollowing business:

(1) Comparisons and verifications of the new prototypes of the meter and kilogramme; (2) the preservation of the international prototypes; (3) periodical comparisons of the national standards with international prototypes, as well as comparisons of standard thermometers; (4) the comparison of new prototypes with the fundamental standards of such non-metrical weights and measures as are used in different countries and in the sciences; (5) the adjustment and comparison of geodesic apparatus; and (6) the comparison of standards and scales of precision whose verification might be asked for either by governments or scientific societies, or even by artists and scientists.

An international committee, composed of fourteen members—physicists, mathematicians, surveyors, and astrono-

(*Continued on page* 164.)

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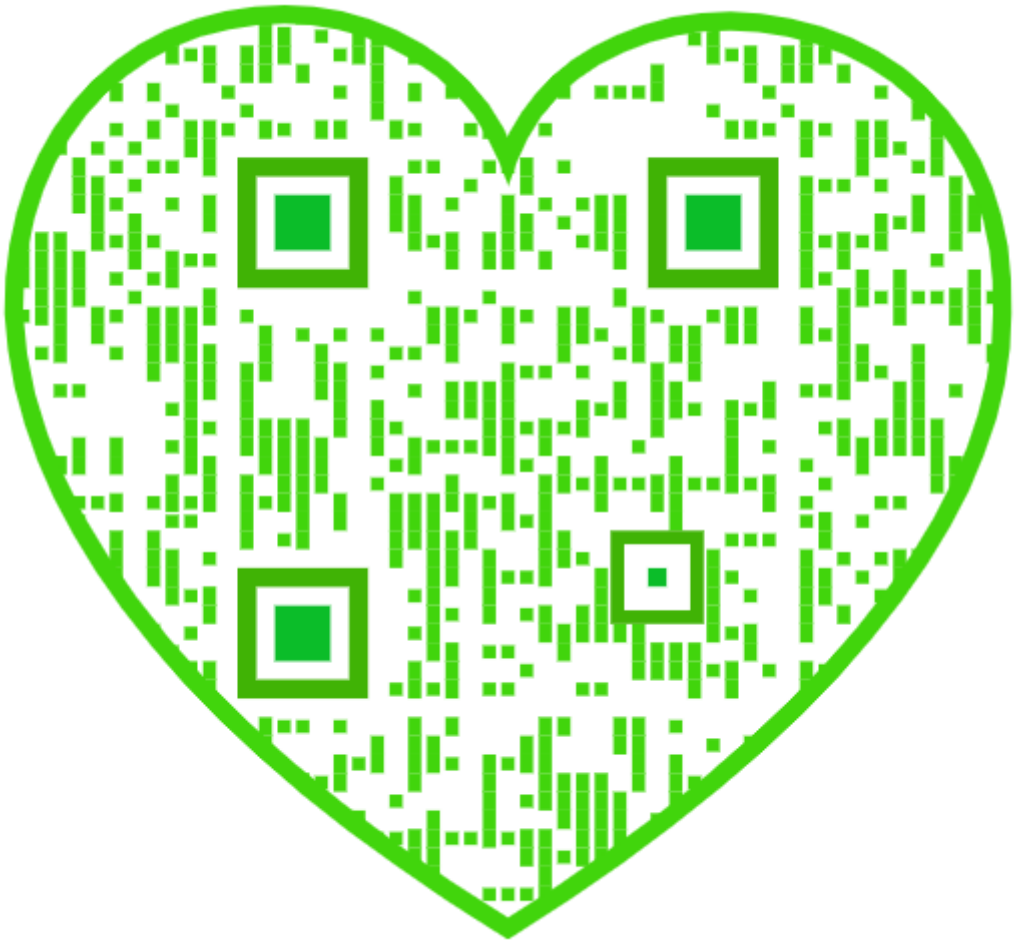

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NEW YORK, SATURDAY, SEPTEMBER 15, 1883.


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**PETROLEUM FOR LIGHT.**

Two revolutions may fairly be considered to be the results of the introduction of petroleum as an agent in the advance of modern civilization. One of these is yet, to a certain extent in the future, undeveloped for the present, and we may study it by and by. The other is of daily experience; its import is indicated by the title above given.

A bright light in the home is so absolutely and intimately associated with cheerfulness and domestic enjoyment and with the higher grade of social life which is the sure attendant of all intellectual advancement, that it becomes a difficult thing to overestimate the value of that which places such a light within the reach of those whose pecuniary resources are small. Of the wealthy we need not speak, but for the greater proportion of every community the means of brilliant illumination at small expense does more for health, for preservation of life, for happiness, for morality, for social elevation, than words can express. If the degree of civilization of a nation can be estimated by the condition of its roads, more truly is it shown by the light in its dwellings. Dimness, degradation, and depravity are not merely an alliteration.

And here is where petroleum has a mighty claim to our respect, and where, as stated, it has caused a revolution, and this revolution is one of our own day. Why have New Bedford, Nantucket, New London, and Sag Harbor ceased to have the importance which they formerly held? Forty years ago, when their whale ships arrived from the Indian Ocean, the Northwest, or the Arctic, their casks represented in their contents of whale oil or sperm oil a certain amount of light or lubrication, which was absolutely necessary for the comfort and the progress of communities. Those same casks would represent exactly the same amount of light and lubrication now, but with a totally different relation to the world's requirements. The dim tallow candle, with the plain tin lamp whose two round wicks, crusted and smoked with whale oil, was superseded by the better lamp of glass, burning a better oil—sperm—and giving a brighter light, and then came camphene and the burning fluids, brighter still, to be followed up by coal oil, so called because it was distilled from soft or bituminous coal. And then, when it was found that this same substance could be produced much more cheaply in another way, coal oil died, while, phœnix-like, kerosene lived in its stead, and still lives and bids fair to live and reign indefinitely.

Of the nature and origin of petroleum we may speak at another time, calling attention here only to the fact that it is the complete analogue in a liquid form of coal as a solid, particularly bituminous coal, which it closely resembles. It is called a hydrocarbon, meaning a combination of hydrogen and carbon. It is, however, a coupled series of hydrocarbons blended in one, and, what seems very singular to one not conversant with chemical working, these various hydrocarbons can be separated perfectly, simply by careful management of heat.

When crude petroleum, in a retort, is subjected to a very gentle heat, light vapors pass off which are exceedingly and dangerously inflammable and can be condensed to liquid form only with much difficulty. Cymogene first, and then rhigolene are formed, but have scarcely been turned to account as yet, except that rhigolene has been employed as a local anæsthetic, by means of its almost instantaneous evaporation. But when the liquid from the retort has reached a specific gravity of 95° B., it can be made available. The pipe is then transferred to another tank, the heat is increased, and the distillation is continued until the escaping liquid stands at 65°. The average gravity in this tank is about 80°; the liquid is crude naphtha.

The heat is still further raised, the pipe goes to another tank, and continues till the gravity becomes 38°, and the color becomes somewhat yellowish. This is the universally known *kerosene*, and its specific gravity should be 51° to 55°.

But this is not the way in which kerosene was first made. This name was given to it by Abram Gesner of Prince Edward's Island in 1846, though the name was not generally adopted for a long time, and it came into very common use as *coal oil*, for it is obtained very readily by distilling any of the bituminous coals, and was made in large quantities by James Young of Glasgow as early as 1850, using Boghead cannel coal or Torbanehill mineral.

The first factory in this country was established in 1854, on Newtown Creek, near what is now the well known and notorious Hunter's Point, on Long Island, opposite New York. The work still continues actively there, new factories having been added, and the odors which they have steadily poured forth have been nauseous beyond description. We well know the efforts which have been made to abate the nuisance.

As the production was very profitable, works were erected in great numbers, all along the coal regions of Kentucky, Ohio, Virginia, etc., as well as on the coast. In 1860 the amount of coal oil yielded by the coast distilleries alone was 200,000 barrels. But while these works were thus in the full tide of success they were suddenly brought to the very verge of ruin. Petroleum had begun to pour upon the market in enormous quantities, and it was found that kerosene, identical with the coal oil, could be distilled from it much more cheaply than from the coal. The fright was extreme, but it was of short duration, for the ingenuity of the distillers proved itself competent to meet the difficulty. They modified their apparatus with but small expense, so as to use the new material instead of the old; the name *coal oil* was speedily dropped, and in its place *kerosene* became a household word.

From the statements here made it is easy to see that the desire for gain may readily lead unprincipled men to risk the lives of their fellow beings most fearfully. If a distiller of petroleum will but turn the pipe from his retort into the kerosene tank a very few degrees before the liquid has reached the proper point, say 68° to 70°, he greatly increases the yield and the profit. Kerosene is what he wishes to sell, and he has now in his tank, of what he calls kerosene, a much larger quantity than should be there, simply because it has received so many gallons that ought to have gone into the naphtha tank. Such a liquid will burn of course, and it has the odor of kerosene, but it is most fearfully explosive. Gunpowder may be handled in the midst of matches, lighted cigars, etc., etc., with far greater safety. The great frequency of horrible accidents is due mainly to this cause. The use of kerosene of proper specific gravity is free from danger, with any average degree of carefulness. Whether any legislative enactments will ever cure the evil, so long as men are selfish and reckless, seems doubtful. But even with this risk the advantages of kerosene as an illuminator are so many that it will hold its ground.

We are in receipt of a note from "a subscriber," signing himself W. M. L., who incloses a slip cut from the Philadelphia *Ledger* of August 23, on "The Recent Lamp Explosion." He asks for explanation. The paper states that, as they understand, "the flame was driven down into the lamp (which was a very strong one) by the movements of Mrs. Muller. . . . The oil itself is said to have been of good quality," and the inference is therefore that the unfortunate Mrs. Muller owed her death to gross carelessness on her own part. It may be that this is true, but there is no proof of it.

If the oil had been what it professed to be—*kerosene*—there is little doubt that she might be at this moment in life and health, and if it were possible some one ought to be held responsible for her death, that one being the manufacturer, who to increase the contents of this kerosene tank turned the discharge pipe from his retort into it while the gravity was too low, say 70° or perhaps even a greater figure still, and thus put into the market the dangerous mixture of naphtha and kerosene which Mrs. Muller's lamp contained, and whose like is so constantly bought by those whose necessities or whose parsimony causes them to use cheap kerosene.

It is worth while to repeat here, "the use of kerosene of proper specific gravity is free from danger with any average degree of carefulness." The explosions of lamps do not occur from its employment. The lamps themselves are seldom to blame, but it should be enforced upon the minds and attention of the community, by every means in our power, that it is fully as safe to handle a rattlesnake, or to fool with a bottle of nitroglycerine, as to burn kerosene containing much of the lighter oil. One may escape death in either case, but he does not deserve any such good fortune.

We have no disposition to assert that kerosene of the most perfect quality may not explode, and cause fearful havoc. When Bridget begins to pour it on the coals to make them burn quicker, there is quite a possibility that she may stop pouring of a sudden, and the kerosene not be culpable. We saw a young man pour powder that way once from his flask, thinking he could close the spring when it began to flash. He was not quick enough, but it was very good powder.

**EXPORTS OF MANUFACTURES.**

Although the present foreign demand for an article of American manufacture may not amount to one per cent of the home consumption, it is well known that most of our manufacturers make their lowest prices for such export trade. No one belittles the importance of our great yearly exports of grain, cotton, and provisions, but a keener and more personal interest is at once manifested when any increase of shipments of manufactured goods can be noted. The foreign markets for our agricultural products depends largely upon the more or less favoring seasons, here and abroad, but these have nothing to do with shaping the keen competition under which our mills and workshops, our capitalists and mechanics, are reaching out to obtain a larger portion of the world's trade in manufactured articles. It is especially gratifying, therefore, to find, from recent reports of the Bureau of Statistics, that while the total exports for the last fiscal year are valued at more than seventy million dollars in excess of those for the preceding twelve months, a large part of this increase is made up of manufactures.

At the Millers' Convention in Cincinnati, two years ago, it was urged by many in that trade from abroad that, unless English and Continental millers modified their processes and improved their mills, American millers would in the future give them a closer competition than ever before. Well, the exports of wheat flour the last fiscal year, to July, 1883, amounted to 9,205,664 barrels, valued at $54,824,459, against 5,915,686 barrels, valued at $36,375,055, for the preceding twelve months. These figures show that the foreign millers who came over at that time to investigate the state of their industry here had most excellent grounds for their apprehensions.

In iron and steel and their manufactures the exports do not show a large increase, but that there is a positive growth, with a large diminution in our imports in this line, is at once a source of gratification to the home and disappointment to the foreign trade. With the recent great activity in railroad building it had been expected that we

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would be more free buyers abroad, but the imports of the last year only figure for $40,796,007, against $51,377,633 the year preceding, while our exports advanced from $17,551,322 to $19,165,321 during the same period. This, it will be remembered, is our largest industry (next to agriculture), and great as are England's advantages, we think it no overconfidence to expect a steady increase in the exports, especially in stationary and locomotive engines, boilers, car wheels, edge tools, fire-arms, and general machinery, in all of which there has been a healthy growth in our foreign trade the past year.

The percentage of imported to home manufactures consumed, taking the figures of the last census for the latter, shows in a most gratifying way how small comparatively many of our imports are when considered in connection with the great and varied demands of our people. In agricultural implements, while producing to the value of nearly seventy million dollars, we imported nothing, and exported last year $3,940,509, an increase of about one million on the preceding twelve months. In beer, ale, and porter, with production over a hundred million dollars, imports were only 0·74 of one per cent. In carriages, carts, etc., while producing $76,971,137, the imports were 0·12 of one per cent, with exports last year of $1,607,502. In railroad cars we import nothing, but last year exported $1,900,903. In cotton manufactures and mixed textiles we imported 8·78 per cent of our consumption, exporting not quite half as much. In jewelry, etc., with manufactures of $33,896,910, the imports were only 0·85 of one per cent, and the exports of last year were $422,854. In leather we are still considerable purchasers of fine calf and kid skins, and with a total production exceeding two hundred million dollars in value, imported 3·62 per cent of our consumption, exporting about an equal value in heavy sole leather. In paper and stationery, while manufacturing to the value of $180,179,380, we used 0·99 of one per cent of foreign, and our exports last year were $1,589,908. In plated ware, printing presses and types, scales and balances, and a thousand lesser articles, we imported nothing, although there is hardly an article in the list of which we do not export to some extent.

In the whole outlook of our business, as affected by imports and exports, there is but one point on which the eye can rest with serious dissatisfaction, and that is in remembering that nearly all of our carrying trade with foreign ports, both imports and exports, is done by vessels built and owned abroad. We sold last year to foreigners only $169,209 in both steam and sailing vessels, or only about one tenth the value of an ordinary Atlantic liner, so that our shipbuilders can only find employment in working for the coasting trade or in an occasional government contract. With a fair proportion of the ocean carrying trade in American hands we should undoubtedly experience a great augmentation of our exports of manufactures, and be able to compete with foreign producers on far better terms in the markets of South America, Australia, on the Indian Ocean, and elsewhere.

## ECONOMY OF STEAM.

The suggestion was recently made that power might be economized in the use of steam engines by employing the steam, not as the direct motive force in driving whatever machinery was involved, but rather by causing it to expend its energy in forcing air into a suitable reservoir, this compressed air cylinder furnishing then the active agent for propulsion. The object at that time was that wind wheels might come in as coadjutors to the steam engine, by yielding their own quota to the stock of compressed air, and thus saving precisely so much of steam power, which means of course *fuel.*

But if this method of using steam could be brought into practical service, economy could be secured in a totally different direction, to which our attention is called by the title above given.

Whenever, and wherever, a steam engine is at work, it must be kept at its full working head of steam, nearly up to the very close of its service. Just before a steamer reaches her wharf, or before the six o'clock bell is about to ring for the shutting down of mill or factory work, if the engineer has a surplus of power, he can afford to bank his fires, and economize a trifle by working down a few pounds of his extra steam. But it is only a very little, for he must of course retain enough to drive the engine at its working gait fully up to the last minute. And when the bell rings and he shuts off steam for the end of the trip or the close of the day's work, his gauge shows a pressure but a few pounds below that at which he regularly runs. His boiler therefore is now a reservoir of power which is practically to be wasted. He either "blows off steam," or he does not, according to circumstances, but in either event the greater proportion of that power is lost for service. The dissipation of heat which necessarily takes place before the hour comes for starting again measures precisely the amount of energy wasted, for the vapor of water owes its efficacy only to the heat of recent importation. Without the heat its elasticity is gone. Can we not possibly substitute for it a gas whose elasticity does not depend on recent heat, but is a permanent quality at all temperatures, notwithstanding the fact that an increase of temperature gives an augmented elastic force?

Compressed air furnishes us exactly what we need to answer our purpose. Were the force of the steam used mediately, through an air tank, and not directly, it would be an extremely simple matter to utilize the heat remaining in the boiler, furnaces, etc., so that scarcely any portion of it should be wasted. One turn of a switch would connect the steam power at once with pumps which would go on forcing air into the air tank so long as any power remained. No attention would be needed. When the power was expended the engine would stop moving, and all would remain quiet till required for use. The air thus condensed would be a given amount of active energy ready for application on call, and the efficient service of the engine for the next day would have just that amount furnished to its credit, with no expense added; that degree of expense would be saved. How much this would actually economize must depend on the circumstances, but it would in any case be no insignificant item. Inquiries made of steamboat engineers show that in their judgment it would be sufficient to run the boat from five miles to ten, according to her size and speed. Some go much higher than that. And with a large ocean steamer there can be scarcely a doubt that it would decidedly exceed this. Surely this is a wasted power, which is worth saving. A.

## Fog Signals.

Connected with the Light-house Service is the system of warnings by "fog signals," which comes in use in what the sailors call "thick weather;" that is, when mist or fog prevents the lights and landmarks from being seen either by night or by day.

The principal fog signals used in this country are the siren, the steam-trumpet, the steam-whistle, the whistling buoy, the bell-boat, the bell-buoy, and heavy bells rung by clock-work. The siren is sounded by driving steam through a flat, circular disk, containing a number of slits, the disk being fixed in the throat of an immense trumpet. Behind this is a revolving plate, having in it a similar number of openings. The plate is revolved by steam 2,400 times each minute. Whenever the slits in the plate coincide with those in the disk a jet of steam escapes through each opening, under great pressure, into the trumpet. If there are 10 openings, there will be 24,000 screams each minute. These combined in the trumpet give a single, strong shriek in deafening volume and of great range. The sound can generally be heard at a distance of 20 miles, and can readily be distinguished from all noises at sea. The siren is the furthest reaching fog signal yet produced, but it is the most expensive to build, the most difficult to run, and the most costly to keep going. One of these machines was on exhibition at the Centennial Exposition in 1876, where it made such a nuisance of itself that it was restricted from sounding except at the opening and closing hours, and then it was heard all over Philadelphia. One of the largest size sirens is connected with the light-house at Cape Henlopen, at the mouth of Delaware Bay, opposite Cape May, where in fog it gives a blast 6 seconds long after an interval of 39 seconds. These instruments have done so well on our coasts that other countries have procured numbers of them. Great Britain has more than twenty of them now in operation on her shores.

The Daboll fog trumpet is made like a monster clarinet, and is sounded by air condensed in a reservoir by machinery driven by a hot-air engine. The largest trumpet is 17 feet long, with a mouth 38 inches across and a throat 3½ inches in diameter. Its reed of steel is 10 inches long, 2½ wide, an inch thick at its fixed end and half that at the other. The Ericsson engine that drives it has a 32-inch cylinder, which, at 20 pounds pressure, can give a five-second blast every minute. The Daboll trumpet is, however, going out of favor because of its liability to accident and the difficulty of getting it repaired. The nearest one to us is in Long Island Sound, at Execution Rocks Light Station.

The most frequently used fog signal of this general class is the locomotive steam whistle, with a diameter varying from 6 to 18 inches, operated by an ordinary boiler, under a pressure varying from 50 to 100 pounds. By intervals of blast and silence it can be differentiated from neighboring fog signals, and these intervals automatically produced by having an engine take steam from the same boiler and open and close its valves at fixed times, when the steam is shut off or let on as desired. These instruments do not easily get out of order and they are readily operated. The whistles are used on light-ships as well as at light-houses. There is a 12-inch whistle on each of the light-ships on Five Fathom Bank, off the Capes of the Delaware.

The power of these fog signals can be expressed in proportion thus: siren, 9; whistle, 7; trumpet, 4; and as to cost of running them they stand as follows: siren, 9; whistle, 3; and trumpet, 1. There are 66 fog signals now on our coasts operated by steam or hot air.

The bell-boat, which is at best a clumsy contrivance, liable to be upset when most needed, costly to build, hard to handle, and difficult to keep in repair, has been superseded by Brown's bell-buoy, which was invented by an officer of the Light-house Service. The bell is mounted on the bottom section of an iron buoy, which is decked over and fitted with a frame-work of 3-inch angle iron, 9 feet high, to which a 300 pound bell is rigidly attached. A concentric grooved iron plate is made fast to the frame under the bell and close to it, and a cannon ball is allowed to roll on this plate. As the buoy rolls on the sea the ball rolls on the plate, striking one side of the bell at each roll. The signal is always at work, and the heavier the sea the louder the sound of the bell. There are 24 of these bells now in use in this country, one of which is on Brown Shoal, Delaware Bay. They cost, with their mooring, not far from $1,000 each.

The "whistling buoy" consists of an iron pear-shaped ball, say 22 feet in diameter, with a tube 20 inches across and 40 feet long running through it. The water in the tube acts as a piston to draw in the air through a hole covered with a retaining valve, and to expel it through a 10-inch whistle, making a shrill moaning sound, which can be heard several miles. Its dimensions have recently been reduced, without decreasing its power. As its action depends on rough water, it is only used in open water. They now cost, with their moorings, about $1,200 each. There are 25 of them on our coasts, 5 of which are in our immediate waters. The whistling buoy recently placed on the outer Hatteras shoal, just off the pitch of the Cape, is of the greatest use to our coasters.

The bell fog signal most in use is the bell struck by machinery and moved by clock work. There are about 120 of these bells. They weigh from 300 to 3,000 pounds each, though not many weigh more than 1,000 pounds.—*Phil. Ledger.*

## PASSAGE OF THE NEW BRITISH PATENT LAW.

After prolonged discussion and many amendments the new patent bill for Great Britain has passed both houses of Parliament, has received the royal assent, and will come into force January 1, 1884. We have not yet received the full text of the law, but we are advised by our London correspondent that among its principal features are the following:

A material reduction has been made in the cost of applications for patents, which we roughly calculate will not exceed $100 for the complete patent, including both agency and government fees for the provisional and final specifications. It is difficult, of course, to say, definitely, what the incidental expenses will be until we can by practical experience ascertain exactly the amount of work involved by reason of the various objections and requirements which may be made by the examiners in each particular case, but we think that the amount named will cover all exenses.

Another feature is the extension of provisional protection to nine months, also to substitution of annual taxes in lieu of the £50 and £100 stamp duties now charged, the same total amount being, however, payable; but the first annual tax not being payable until the fourth year after the grant of the patent. These provisions also apply to patents now in course of application, and also to patents already granted on which the £50 and £100 taxes fall due after January 1st next.

In view of the changes it will readily be perceived that the new act will give a great impetus to the taking out of patents in Great Britain, for it may be fairly calculated that a proportion of the patents taken out in the United States and in other countries will also be secured in England.

It is now proposed, under the new law, to follow the system of examination as in the United States and Germany, but to adhere to the practice hitherto prevailing in England; that is to say, to issue the patent to the applicant without examination, at his own risk. It is, nevertheless, proposed to create a body of examiners whose principal duties will be to see that the invention described and claimed in the final specification is the same as that described in the provisional, and that the scope of the patent is strictly limited to a single invention.

This is an excellent provision, and ought to be adopted in our law. Our present system of official examination is, practically, a hinderance and an annoyance to the inventor, not a benefit. It delays the issue of his patent, and in many cases involves him in expensive and harrassing interference contests, which after all decide nothing, as the courts are obliged to review the Patent Office work and determine the validity of the patent. The United States, Canada, and Germany are now almost the only countries that pretend officially to examine. In other countries the patent is always granted, and the inventor examines for himself. If he chooses to pay the fees he may take out a patent, but if it should afterward appear that the invention was lacking in novelty or utility, then the patent is worthless. This is a straightforward system, and works well in all countries where it is in vogue; its adoption here would be a decided improvement in favor of inventors; it would lighten the duties of our Patent Office examiners, and enable them to do better work in respect to those necessary features of examination which the new English law contemplates.

Another important provision of the new English law is that power is taken to conclude international arrangements, so that the publication in England of the foreign specification for a period of six months shall not invalidate a patent applied for during that period; furthermore, the duration of the patent will always be fourteen years, notwithstanding the lapsing of a previous foreign patent of a shorter term.

DR. H. F. HAMILTON says that at least once a day girls should have their halters taken off, the bars let down, and be turned loose like young colts. "Calisthenics may be very genteel, and romping very ungenteel, but one is the shadow, the other the substance, of healthful exercise."

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## SCIENTIFIC SHOWS.—SWORD SWALLOWERS.

When a physician introduces his finger, the handle of a spoon, or a pencil into the throat of a patient, the latter experiences an extremely disagreeable sensation. Any touching, however slight it be, of the pharynx causes strangling, pain, and nausea, and the organ reacts with violence against the obstacle that presents itself to free respiration. There is no one who has not more than once experienced this disagreeable impression, and for this reason we are justly surprised when we meet with people who seem to be proof against it, and who, for example, introduce into their pharynx large, solid, and stiff objects like sword blades, and

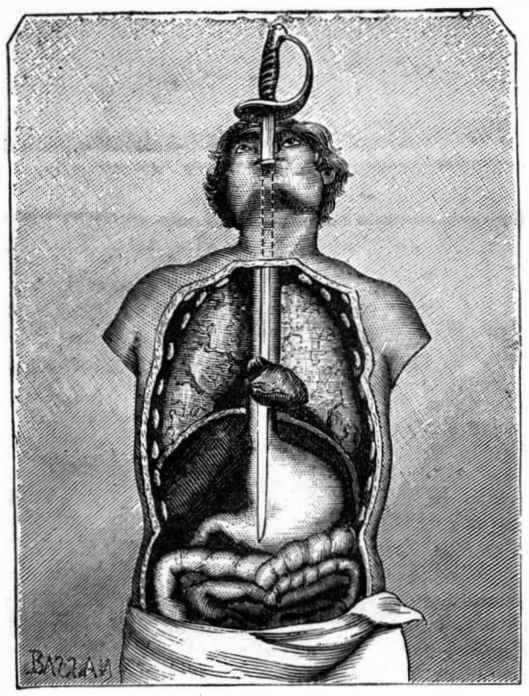

**Fig. 3.—POSITION OCCUPIED BY THE SWORD BLADE IN THE BODY.**

cause these to penetrate to a depth that appears incredible. It is experiments of this kind that constitute the tricks of sword swallowers.

These experiments are nearly always the same. The individual comes out dressed in a brilliant costume. At one side of him there are flags of different nationalities surrounding a panoply of sabers, swords, and yatagans, and, at the other, a stack of guns, provided with bayonets (Fig. 1). Taking a flat saber, whose blade and hilt have been cut out of the same sheet of metal (Fig. 2), the blade being from 55 to 60 centimeters in length, he introduces its extremity into his throat, taps the hilt gently, and the blade at length entirely disappears. He then repeats the experiment in swallowing the blade at a single gulp. Subsequently, after swallowing and disgorging two of these same swords, he causes one to penetrate up to its guard, a second not quite so far, a third a little less still, and a fourth up to about half its length, the hilts being then arranged as shown in Fig. 2 (C).

Pressing, now, on the hilts, he swallows the four blades at a gulp; and then he takes them out leisurely, one by one. The effect is quite surprising. After swallowing several different swords and sabers, he takes an old musket, armed with a triangular bayonet, and swallows the latter, the gun remaining vertical over his head. Finally, he borrows a large saber from a dragoon who is present for the purpose, and causes two-thirds of it to disappear. As a trick, on being encored, the sword swallower borrows a cane from a person in the audience, and swallows it almost entirely.

A certain number of spectators usually think that the performer produces an illusion through the aid of some trick, and that it is impossible to swallow a sword blade. But this is a mistake, for sword swallowers who employ artifices are few in number and their experiments but slightly varied, while the majority really do introduce into their mouth and food passage the blades that they cause to disappear. They attain this result as follows:

The back parts of the mouth, despite their sensitiveness and their rebellion against contact with solid bodies, are capable of becoming so changed through habit that they gradually get used to abnormal contacts. This fact is taken advantage of in medicine. It daily happens that persons afflicted with disorders of the throat or stomach can no longer swallow or take nourishment, and would die of exhaustion were they not fed artificially by means of the œsophageal tube. This latter is a vulcanized rubber tube which the patient swallows, after the manner of sword swallowers, and through the extremity of which an aid introduces milk or bouillon. But the patient, before being able to make daily use of this apparatus, must serve a genuine apprenticeship. The first introduction of the end of the tube into the pharynx is extremely painful, the second is a little less so, and it is only after a large number of trials, more or less prolonged, that the patient succeeds in swallowing 30 or 40 centimeters of the tubing without a disagreeable sensation.

The washing out of the stomach, performed by means of a long flexible tube which the patient partially swallows, and with which he injects into and removes from his stomach a quantity of tepid water by raising the tube or letting it hang down to form a siphon, likewise necessitates an apprenticeship of some days; but the patient succeeds in accustoming his organs to contact with the tube, and is finally able, after a short time, to swallow the latter with indifference at least, if not satisfaction.

With these sword swallowers it is absolutely the same; for, with them, it is only as a consequence of repeated trials that the pharynx becomes sufficiently accustomed to it to permit them to finally swallow objects as large and rigid as swords, sabers, canes, and even billiard cues.

Swallowers of forks and spoons serve an analogous apprenticeship. As known, the talent of these consists in their ability to introduce a long spoon or fork into their throat while holding it suspended by its extremity between two fingers. This trick is extremely dangerous, since the œsophagus exerts a sort of suction on all bodies that are introduced into it. The spoon or fork is, then, strongly attracted, and if the individual cannot hold it, it will drop into his stomach, whence it can only be extracted by a very dangerous surgical operation—*gastrotomy*. It was accidents of this kind that made the "forkman" and the "knifeman" celebrated, and, more recently, the "spoonman," who died from the effects of the extraction from his stomach of a sirup spoon 24 centimeters in length.

All sword swallowers do not proceed in the same way. Some swallow the blade directly, without any intermediate apparatus; but in this case, their sabers are provided at the extremity, near the point, with a small bayonet-shaped appendage over which they slip a gutta-percha bale without the spectators perceiving it (Fig. 2, F and G). Others do not even take such a precaution, but swallow the saber or sword just as it is.

This is the mode of procedure of an old zouave especially, who has become a poor juggler, and who, in his experiments, allows the spectators to touch, between his sternum, the projection that the point of the saber in his stomach makes on his skin.

But the majority of sword swallowers who exhibit upon the stage employ a guiding tube which they have previously swallowed, so that the experiments they are enabled to perform become less dangerous and can be varied more. This tube, which is from 45 to 50 centimeters long, is made of very thin metal. Its width is 25 millimeters, and its thickness 15 (Fig. 2, B). These dimensions permit of the easy introduction of flat-bladed sabers, among other things, and of the performance of the four saber experiment, and of the introduction of sabers and swords of all kinds.

To explain the matter from a physiological standpoint, the saber swallowed by the performer enters the mouth and pharynx first, then the œsophagus, traverses the cardiac opening of the stomach, and enters the latter as far as to the antrum of the pylorus—the small cul-de-sac of the stomach. In their normal state these organs are not in a straight line, but are placed so by the passage of the sword. In the first place, the head is thrown back so that the mouth is in the direction of the œsophagus, the curves of which disappear or become less; the angle that the œsophagus makes with the stomach becomes null; and, finally, the last-named organ distends in a vertical direction and its internal curve disappears, thus permitting the blade to traverse the stomach through its greater diameter; that is to say, to reach the small cul-de sac (Fig. 3). It should be understood that before such a result can be attained the stomach must have been emptied through fasting on the part of the operator.

The depth of 55 or 60 centimeters to which these men cause their instruments to penetrate, and which seems extraordinary to spectators, is explained by the dimensions of the organs traversed. Such lengths may be divided thus:

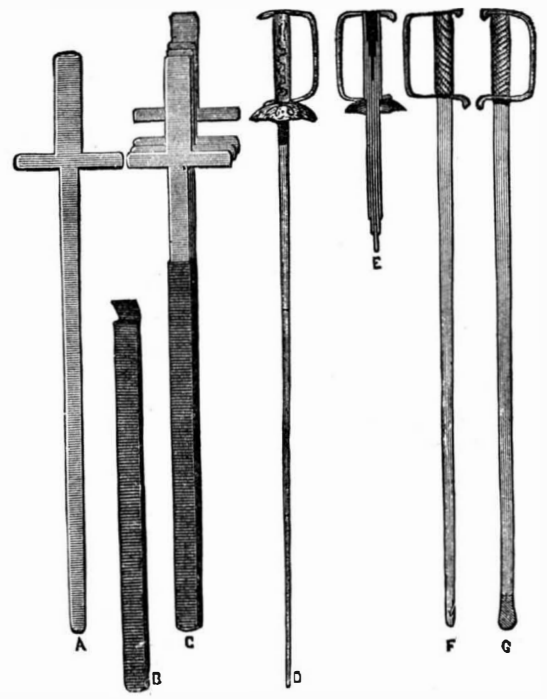


**Fig. 2.—VARIOUS APPARATUS FOR SWORD SWALLOWERS.**

| | |
|---|---|
| Mouth and pharynx | 10 to 12 |
| Œsophagus | 25 to 28 |
| Distended stomach | 20 to 22 |
| | 55 to 62 |

According to the stature of the individual, a length of organs of from 55 to 62 centimeters may give passage to swallowed swords without inconvenience.

Sword swallowing exhibitors have rendered important services to medicine. It was due to one of them—a swallower of both swords and pebbles—that in 1777 a Scotch physician, Stevens, was enabled to make the first studies upon the gastric juice of human beings. In order to do this, he caused this individual to swallow small metallic tubes pierced with holes and filled with meat according to Reaumur's method, and got him to disgorge them again after a certain length of time. It was also sword swallowers who showed physicians to what extent the pharynx could become habituated to contact; and from this resulted the invention of the Foucher tube, the œsophageal tube, the washing out of the stomach, and the illumination of the latter organ by the electric light.

It sometimes happens that sword swallowers who exhibit in public squares and at street corners are, at the same time, swallowers of pebbles, like him whose talents were utilized by Stevens, that is to say, they have the faculty of swallowing pebbles of various sizes, sometimes even stones larger than a hen's egg, and that, too, to the number of four, five, or six, sometimes more, and of afterward disgorging them one by one through a simple contraction of the stomach. Here we have a new example of the modification of sensitiveness and function that an individual may secure in his organs by determination and constant practice.

In conclusion, let us say a word in regard to the tricks that produce the illusion of swallowed swords or sabers. One of these, which deceives only at a certain distance, consists in plunging the saber into a tube that descends along the neck and chest under the garments, and the opening of which, placed near the mouth, is hidden by means of a false beard. Another, and much more ingenious one, which has been employed in several enchantment scenes, is that of the sword whose blade enters its hilt, and which is due to Mr. Voisin, the skillful manufacturer of physical apparatus. In its ordinary state this sword has a stiff blade, 80 centimeters in length, which, when looked at from a distance of a few meters, presents no peculiarity (Fig. 2, D); but when the exhibitor plunges it into his mouth, the spectator sees it de-

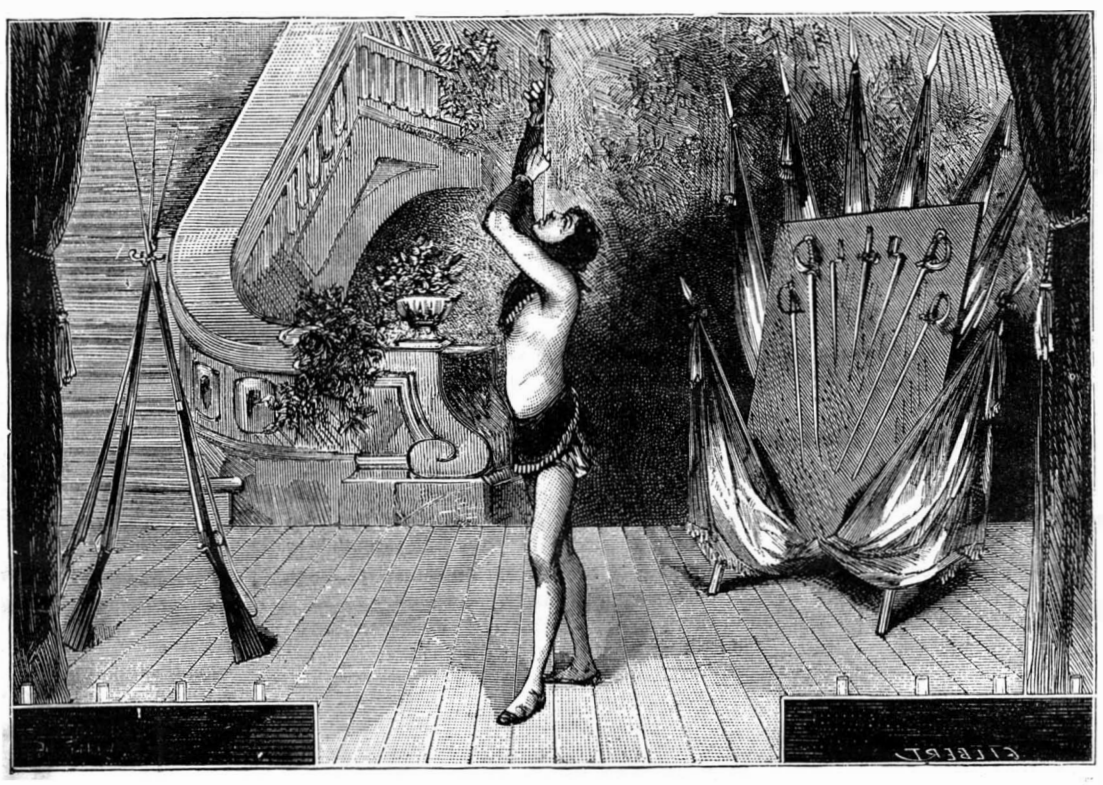

**Fig. 1.—A SWORD SWALLOWER.**

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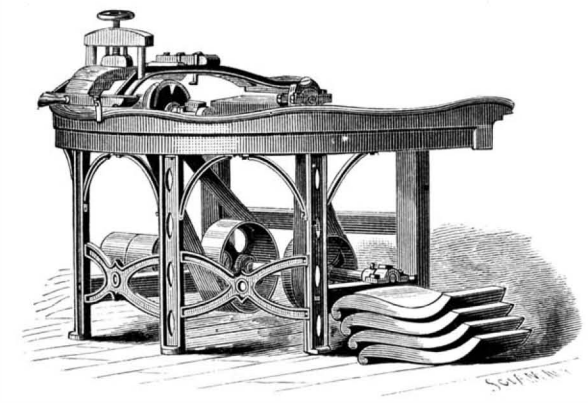
scend by degrees, and finally so nearly disappear that but a few centimeters of the blade protrude. In reality, the blade has entered into the hilt, for it possesses a solid tip that enters the middle part, which is hollow, and these two parts enter into the one that forms the base of the sword. The blade is thus reduced to about 25 centimeters, a half of which length enters the hilt. There then remain but a few centimeters outside the exhibitor's mouth, so that he seems to have swallowed the sword (Fig. 2, G and E). This is a very neat trick.—*La Nature.*

### ROCKER SEAT WORKER.

We give an engraving of a very simple and efficient machine for working the seats of rocking chairs. This machine has a block carrier which is moved over a guide or form, and also over the rotary cutter, which shapes the wood uniformly and rapidly. The manufacturer informs us that this machine has a capacity of from 400 to 600 rocker seats per day. No particular skill is required to



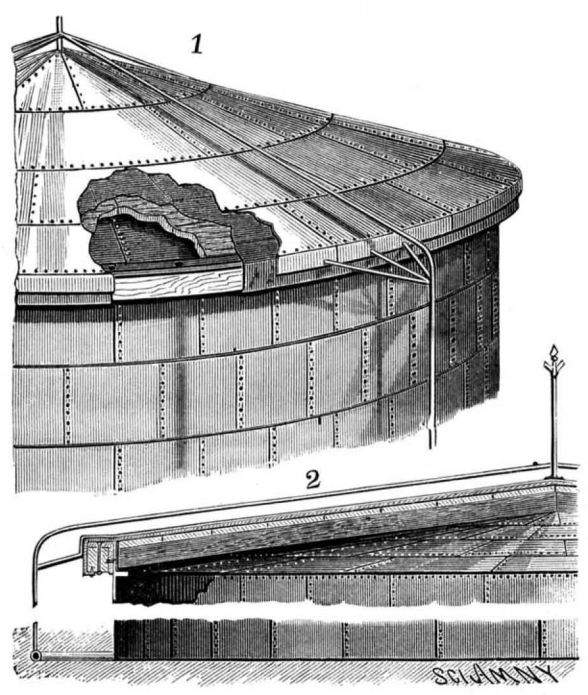
CROSS' ROCKER SEAT WORKER.

operate it. It is not liable to get out of repair, and it is not an expensive machine, considering the amount of work it will do.

Mr. S. W. Cross, of Dodge Centre, Minn., is the manufacturer of this machine.

### DEVICE FOR PROTECTING OIL TANKS FROM LIGHTNING.

After almost every thunderstorm we hear of oil tanks having been fired by lightning, causing the destruction of a vast amount of property. Up to the present time there has been no very reliable means of averting this loss, although various plans have been suggested. We give an engraving of an invention intended to prevent the destructive action of lightning. It consists of a roof with wood or iron rafters, on which are secured boards extending to the outer edge of an angle iron, secured to the top of the outer surface of the tank or building. An asbestos sheathing is tacked on the boards, then lapped over the edge of the angle iron, and lapped against the outer side and bottom edge of a wooden strip held to the bottom of the horizontal flange of the angle irons by bolts passed through the flange and strips, as shown. The edge of the asbestos sheathing is tacked to the strip. The heads




PROTECTION FOR OIL TANKS.

of the bolts are below the asbestos sheathing, and are countersunk in the upper surface of the horizontal flange of the angle iron.

A sheet iron covering is placed on the sheathing and projects beyond and down over the edge of the angle iron. A series of conductors extend over the roof, and are connected with the edges of the metal covering, and are then carried down to the ground and connected to a gas pipe surrounding the tank and buried in the ground. A conductor extends from the gas pipe to suitable ground plates in marshy or other moist ground.

The asbestos insulator makes the tank fireproof, and is a non-conductor of electricity. If lightning strikes the tank and does not immediately pass down the conductors, it will pass down the metal covering and then through the conductors to the gas pipe.

This invention has been patented by Mr. Henry C. Thomas, of Rock View, N. Y.

### The Factory Numbering of Yarns.

All yarns, whether of cotton, woolen, worsted, or other material, are numbered according to their size. A No. 1 cotton yarn contains 840 yards to the pound, and a No. 10 contains ten times that amount, or 8,400 yards. No. 40 cotton yarn contains 40 times 840, or 33,600 yards to the pound, and its diameter consequently only one-fortieth as great as that of No. 1.

Woolen yarns are measured in "runs" of 1,600 yards to the pound. Two run yarn contains 3,200 yards to the pound, three-run 4,800, ten-run 16,000, and so on.

No. 1 worsted yarn always measures 560 yards to the pound, and No. 10 is one-tenth as large, and measures 5,600 yards to the pound. As a matter of fact, but little if any worsted yarn is spun coarser than No. 10, and the finest commonly made is No. 65, though some mills run as small as No. 90. No. 90 worsted yarn contains 50,400 yards to the pound, and its smallness can therefore be readily imagined. The No. 16 worsted yarn, in most common use for knitting, contains only 8,960 yards to the pound, but is generally made of very fine wool.—*Textile Gazette.*

### Tile Making in Holland.

The tiles manufactured in Holland are flat, hollow, S shaped, or with a square opening in the middle to let in a pane of glass, being much used for lighting lofts and garrets all over the Low Countries. They are either red, gray, or blue, or glazed on one side only. The flat paving tiles are about 8½ inches square by 1 inch thick; they are used principally for cisterns and for bakers' ovens. The clay for tiles, it is to be noted, is in all cases more carefully prepared than that for bricks, being ground up wet in a pugmill or tub, with a shaft carrying half a dozen blades. By this means, roots, grass, etc., are got rid of. The clay comes out of the pugmill of the consistence of potter's clay, and is kept under a shed, where it is kneaded by women, with their hands, to the rough form of a tile, on a table dusted with sand. These pieces are carried off to the moulders, who are two in number, a rough moulder and a finisher. The tiles are then dried under sheds, and afterward in the sun. With regard to the flat paving tiles, they are at first rough-moulded about an inch larger than the subsequent size, and a little thicker, and then laid out to dry under a shed, until such time as the thumb can hardly make an impression on them. They are then taken to a finishing-moulder, who, on a table quite level and slightly dusted with sand, lays one of the tiles, and strikes it twice or thrice with a rammer of wood larger than the tile, so as to compress it. He then takes a mould of wood, strengthened with iron and with iron cutting edges, and puts it on the tile, which he cuts to the size. The mould is of course wetted each time it is used. The tiles are then regularly dried. In Switzerland and Alsace an iron mould is used.

The tile kiln is generally within a building, and about 16 feet long (in ordinary dimensions), 10 feet wide, and 10 feet high. The walls are from 4½ feet to 5 feet thick, secured outside with great beams, and so secured together as to form a square frame. Some of the largest of them are pierced with four flue holes, as in brick kilns; but the flues are formed by a series of brick arches, about 2½ feet wide by 16 inches high. The opening of the flue hole is about 10 inches by 8 or 9 inches high. On their upper surface, these series of arches form a kind of grating, on which the tiles are laid. The kiln is covered in at the top with a brick arch, pierced with holes of different sizes. The kilns are charged from an opening which is constructed in one of the side walls, which opening is, of course, during the burning, blocked up and well secured. The fuel used is turf, as in the brick kilns, and the fire is kept up for forty hours together, which is considered enough for the burning. Three days are then allowed for cooling, and they are afterward taken out of the kiln. Those tiles which are to be made of a grayish color are thus treated. It having been ascertained that the tiles are burnt enough, and while still red hot, a quantity of small fagots of green alder with the leaves on is introduced into each flue. The flue holes are then well secured, and the holes in the roof each stopped with a paving tile, and the whole surface is covered with 4 inches or 5 inches of sand, on which a quantity of water is thrown, to prevent the smoke from escaping anywhere. It is this smoke which gives the gray color to the tiles, both internally and externally. The kiln is then left closed for a week, when the sand is taken off the top, the door and roof holes are opened, as also the flue holes, and the charcoal produced by the fagots taken out. Forty-eight hours after, the kiln is cool enough to allow of the tiles being taken out, and the kiln charged again. Whenever any of the tiles are to be glazed they are varnished after they are baked; the glaze being put on, the tiles are put in a potter's oven till the composition begins to run. The glaze is generally made from what are called lead ashes, being lead melted and stirred with a ladle till it is reduced to ashes or dross, which is then sifted, and the refuse ground on a stone and resifted. This is mixed with pounded calcined flints. A glaze of manganese is also sometimes employed, which gives a smoke-brown color. Iron filings produce black; copper slag, green; smalt, blue. The tile being wetted, the composition is laid on from a sieve.

The manufacture of tiles is principally carried on near Utrecht, in the province of Holland, which, like most of the great cities of Holland, has facilities for the transportation of its produce by water communication all over the country.—*Glassware Reporter.*

### IMPROVED FRYING PAN.

The engraving shows a novel frying pan recently patented by Mr. Oliver E. Worden, of Pierre, Dakota Territory. The design of the invention is to do away with the smoke that results from frying meat and other articles of food, and to prevent grease from spattering out of the pan.

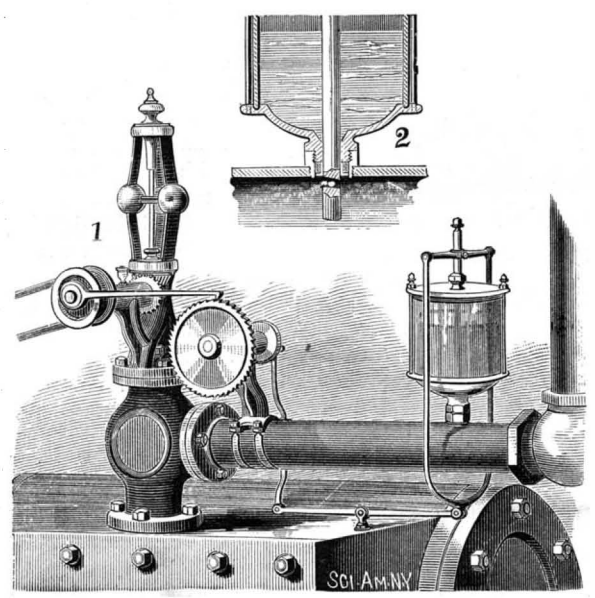
The pan is made double; the inner one is of ordinary con-

IMPROVED FRYING PAN.

struction; the outer one is made larger in diameter than the inner one and has no bottom. The inner pan is supported on a cross bar extending across the outer one, and a space is left all around to permit the smoke to escape to the fire space or flue of the stove or range. The removable cover of the outer pan covers both.

### FORCE FEED LUBRICATOR.

In this lubricator the oil cup is situated on the steam supply pipe of the engine, and is provided with a plunger rod, which passes through a stuffing box in the bottom of the cup, and enters the steam pipe. This plunger rod is connected by means of a yoke with a lever, which takes its motion from a crank on the end of a shaft carrying a ratchet wheel. A slow rotary motion is imparted to the ratchet wheel by a pawl reciprocated by an eccentric in some moving part of the machine. In the present case the eccentric is placed on the governor shaft. This arrangement of mechanism slowly reciprocates the plunger rod, so that a transverse hole formed in it near its lower end is alternately raised up into the oil cup to receive oil, and plunged down into the steam pipe to discharge it. The oil is carried by the steam to the valves, piston, and internal surfaces of the cylinder.




WHEELER'S FORCE FEED LUBRICATOR FOR STEAM CYLINDERS.

This device is entirely automatic and positive. There is no steam pressure in the cup, consequently the cup can be of glass, which will permit of seeing when the oil is exhausted. The oil is supplied only when the engine is running, consequently there can be no waste.

This invention has been patented by Mr. J. A. Wheeler, of Vandalia, Mo.

THE Rev. A. P. Happer, D.D., figures out a steady decrease in the population of China. He says the present number of inhabitants cannot exceed 300,000,000. Chief among the causes of the diminution is opium. He believes that the population of India will soon exceed that of China, the latter ceasing to be the most populous country on the globe.

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## THE OBSERVATORY OF THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

(*Continued from first page.*)

mers—belonging to different nationalities has been charged with the direction of the bureau.

The president of this committee is General Ibañez, the Director-General of the Geographical and Statistical Institute of Spain, and its secretary is Dr. Hirsch, the Director of the Observatory of Neuchatel. The committee meets once a year at Paris.

Twenty countries (twenty-two if Austria and Hungary and Sweden and Norway be counted separately) were represented at the preliminary diplomatic conference of 1875, and seventeen (or nineteen) of these signed the international convention that was a consequence of it. A single one of these states not having ratified it, the expenses of founding and keeping up the bureau have been borne by the sixteen (or eighteen) following countries: Germany, Austria, Belgium, the Argentine Confederation, Denmark, Spain, the United States of America, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela. This represents about 351,000,000 of inhabitants that have already contributed more than a million to the founding of the international bureau. More recently the government of Servia has joined the association.

In order that the necessary structures might be erected where no vibrations of the earth were to be apprehended, such as might occur from the passing of vehicles or the running of engines in the heart of a large city, France conceded the land that was formerly occupied in the Saint Cloud Park by the Breteuil Pavilion.

We have recently visited this new establishment—one of the most remarkable of modern scientific installations—and shall give a description of it.

In the front part of the bureau are the laboratories, and back of these are the large halls, through which are distributed the various instruments of precision that are employed in metrological operations. These halls have very thick walls, and receive their light from skylights above, which are arranged in such a way as to prevent the rays of the sun from entering. They are surrounded by a passageway that isolates them from the exterior. The object of these arrangements is to secure as nearly as possible a perfectly uniform temperature, this being a condition necessary for the success of certain operations.

The labors of the bureau are naturally divided into two sections, one of them having to do with standards of length, and the other with those of mass or weight. The first of these occupies itself principally with the establishing of the *equations* of the different standards; that is to say, with their lengths with respect to the prototype which is the universal starting point, the measurement of their expansions, and the study of their subdivisions. The section of weights determines how kilogrammes of the first order agree with the prototype kilogramme, graduates their subdivisions, adjusts specific weights, etc. These different labors are distributed among a certain number of observers, who constitute the *personnel* of the bureau.

We shall take a hasty glance at the principal instruments that belong to each section. These apparatus, which were constructed by one of the most skillful makers in Europe, realize in general the extremest limits of perfection that can be reached by the mechanics of precision.

The instruments of the section of lengths are called *comparers*. A comparer for meter rules consists essentially of two microscopes, which are firmly and immovably fixed, and which are provided with micrometers under which may be successively slid, by an appropriate mechanism, the two rules that it is desired to compare with each other. The bureau possesses several of these instruments, each of which has its special purpose and is consequently distinguished by characteristic peculiarities of construction. The first is the *Brunner comparer*, so called after the skillful makers who constructed it. This is designed for comparing meter rules in the air. The two microscopes are fixed by means of strong cramps to pillars composed of a single stone mounted upon a masonry foundation. The micrometers with which they are provided exhibit the general arrangement usual in astronomical instruments.

Each of them consists of a sort of rectangular, elongated, flat box fixed to the body of the microscope beneath the eyepiece. In this box slides from right to left a frame on which is stretched two very fine, parallel cobweb threads, which are placed very near each other. The sliding of this frame is effected very slowly by means of a micrometer screw, which is actuated by a nut whose circumference is divided into a hundred equal parts. When this nut is revolved by the observer it moves the screw, and this latter in turn moves the frame, along with the cobweb threads visible in the field and the microscope. The image of the division marks traced upon the rule, given by the objective, occurs in the plane of the threads.

To "point" a division is to cause the micrometer threads to coincide with the image of such division; that is to say, to bring the threads, through a play of the nut, into such a position that the division mark shall appear exactly between them; the position occupied by the threads is then given by a reading of the nut. If a second division mark happens to present itself under the microscope in a different position it is necessary, in order to "point" this in its turn, to move the threads; that is to say, to revolve the nut a certain number of divisions. Knowing the distance that corresponds to the moving of one division, the distance between any two marks may be deduced from such measurement. Beneath the microscope is situated the comparer, which consists, in the first place, of a strong cast iron frame, exceedingly strong and massive, forming through its upper edges a sort of railway, upon which runs a heavy carriage that is moved along at will, by means of a winch that actuates a system of gearings. Upon this carriage there is mounted a long metallic box having double sides, that is to say, two boxes, one set within the other. This box receives the two rules that are to be compared, these being placed, one near the other, in its axis, upon supports of an appropriate form. It contains the different mechanisms by means of which the observer, while having his eye at the microscope, can manipulate the rules, cause them to rise or descend, put them in focus at the two extremities and move them longitudinally or transversely as need be. It is capable of receiving, in addition, a certain number of thermometers, which are observed by the aid of special spy glasses carried by the lid that covers the whole and prevents rapid variations of temperature from occurring in the interior of the apparatus. The observer, through a motion of the carriage, brings successively under the microscope the two meter rules whose difference he desires to know, and "points" upon the division marks of each, and this operation, performed at the two extremities, furnishes the equation sought between the two rules.

A second comparer is one designed for measuring expansions, and this is the kind that is represented in the accompanying cut. As in the preceding instrument, we find here two microscopes with fixed micrometers, and a carriage running upon a railway, but carrying in this case two distinct boxes or troughs at a distance of about one meter apart. The two rules to be compared are each placed in one of the troughs, so that they are in a measure independent of each other and may consequently be raised to different temperatures. In order to measure the expansion of a rule, the latter is placed in one of the troughs, while in the other trough there is placed what is called a "comparison rule." This latter is kept, while the determination is being made, at an unvarying temperature, while the other is alternately heated and cooled, in a consecutive series of experiments, between quite wide limits. The rule to be tested, then, alternately contracts and elongates, and, in each experiment a comparison is made of the length that it assumed at the temperature to which it was carried with the constant length of the comparing rule. One of the great difficulties of such measurements is to maintain very constant temperatures for a sufficient length of time, especially when they are notably different from the surrounding temperature. To succeed in doing this the rules to be compared have to be immersed in a liquid, which latter is heated by means of a continuous circulation of water between the double sides of the trough. The rubber tubes seen in the cut are designed for this purpose. The water is supplied by a large metallic reservoir (outside of the hall) in which it is heated by means of a regulating system that causes it to issue at an invariable temperature. From thence it reaches the comparer through pipes, traverses the troughs in a continuous manner, and flows out afterward, through properly arranged waste pipes, into a drain. There may thus be maintained, to within a few hundredths of a degree, a constant thermic state up to 40°, for hours at a time.

The cut shows the principal details of the mechanism. There will be seen in front the winch which, through the intermedium of an endless cord, actuates the carriage and permits of one of the troughs being substituted for the other under the microscopes. On the sides will be observed long rods provided with buttons, which the observer finds always within his reach, whatever be the position that he occupies around the instrument, and which are likewise capable of acting upon the carriage, through a gearing underneath it, and moving it along with a slow and micrometric motion. Upon the covers will be seen the heads of the different keys that permit of rectifying all adjustments, as well as the spy-glasses by means of which the thermometers are read. The hand wheels placed in front of the trough serve to give a rapid rotary motion to the agitators, through the intermedium of cords and pulleys, so as to mix the layers of liquid in the troughs and secure a uniformity of temperature in all parts of the bath.

With these apparatus may be determined, to within *some ten-thousandths of a millimeter*, the difference that exists between two meter rules at a given temperature; it being necessary for this purpose, be it understood, that the division marks of such rules shall be traced with sufficient sharpness to allow of their supporting the magnifications employed.

The two preceding instruments compare only meter rules, but the *Universal Comparer* permits of comparing any lengths less than one meter or up to two meters. This instrument is entirely different in appearance from the others. The microscopes, which are always its essential members, instead of being fixed, are mounted upon carriages that run upon a sort of bridge placed horizontally between two stone pillars. This bridge is a large casting trimmed with steel planes upon its upper edges, which latter serve as a support and guide to the microscopes in their motions. It is perfectly rectilinear and horizontal. When, on rolling the carriages, the microscopes have been brought to occupy the position that they are to have for a given operation, they are fixed by tightening a clamp by the aid of a screw. Beneath there is, as in the preceding comparers, a heavy carriage carrying supports upon which are placed the rules to be studied. These supports are likewise provided with all the rectifying parts necessary, these being maneuvered by means of a mechanism that is so complicated that no idea can be given of it without the aid of figures.

This comparer contains, besides, a standard two meter rule, divided into centimeters throughout its length; two supplementary microscopes mounted upon a special carriage, and designed for graduating subdivisions of a meter; and different accessory pieces serving to compare rules of the same kind with each other or with other kinds. The instrument is wholly inclosed in a large mahogany box provided with the necessary apertures for lighting the different parts and for the transmission of motions to the outside, etc., and having the appearance of an elegant piece of furniture.

This beautiful collection is to be completed in a few months by the acquisition of a *Geodesic Comparer* for four-meter rules.

### Origin of Nitrogen.

The authors, A. Muntz and E. Aubin, show that the only noteworthy agent for the production of nitric or nitrous acid from the free nitrogen of the atmosphere is the electric discharge. They consider that unless the supply of the oxides of nitrogen thus generated is greater in tropical regions than it has been found to be in Europe, it will be difficult to explain, by electricity alone, the compensation of the nitrogen which is incessantly wasted, and especially the accumulation of combined nitrogen which exists on the surface of the globe. Hence another cause must be sought for the production of nitrogenous compounds. It has been proved by the experiments of M. Boussingault upon plants, and those of M. Schloesing upon the soil, that neither of these is able to assimilate free nitrogen. Hence the authors are inclined to seek the source of combined nitrogen in the violent combustions which must have ensued at a certain stage of the earth's existence, when the elements which had been dissociated by an elevated temperature recombined in presence of oxygen and nitrogen, involving the formation of nitrous compounds. It is known, indeed, that large quantities of nitrous acid are formed whenever any body is burnt in air.

According to the authors' experiments, 1 grm. of hydrogen burning in air yields as much as 0·001 grm. nitric acid, while 1 grm. yielded as much as 0·100 grm. Hence at the first appearance of organic beings upon the earth, there existed a large stock of nitrogenous compounds in the air and the soil upon which we are still subsisting, and which is decreasing under the influence of the causes which effect the escape of free nitrogen, unless the supply is kept up by the action of atmospheric electricity.

### Malarial Fever.

In the *New England Medical Monthly* is a communication from Dr. Rufus W. Griswold, of Rocky Hill, Conn., in relation to a case of litigation in Berkshire County, Mass., in which he was a witness. He sums up the facts and their conclusion in an abstract of the testimony to the effect that the flowing of land, and thereby creating a pond of water by a dam, the water being drawn continuously, is not a source of malaria—bad air—or a cause of unusual ill health. One of his best arguments was that the flowing of low lands for ponds to afford water power for manufacturing purposes is almost coeval with our existence as a nation, when we first began manufacturing, and when water power was the only power known for driving machinery. Whereas the low and tertiary fevers known now as "malaria" are of only recent importance. Dr. Griswold says:

"The verdict of the jury in favor of the defendants was the only one that the facts could allow. The best expert testimony the States can afford was brought into use to sustain the prosecution—not simply medical, but sanitary. But before a critical and caustic, but perfectly fair and honest, defense, also conducted by eminent and able counsel who demanded reasons for opinions, and did not allow opinions to go before the jury without reasons—the case of the prosecution, which sought to prove the sanitary and economic evils of the flowage, was a signal failure. The verdict will not be without its lesson to the medical mind, since it will help to enforce the thought that while it is perfectly easy to evolve theories out of coincident conditions, it is not so easy to present reasons for them that will carry conviction to the skeptical intelligence."

### Photography of Love.

A Madrid photographer has, according to the *Archiv*, had a strange sitter to deal with lately. A young lady came to his studio to have her portrait taken. Having placed her in position, he turned to arrange his camera, when, casting a last glance at the posing belle before removing the cap from the lens, he was horrified to see that she was holding the muzzle of a revolver to her temple. "Stop! stop!" he cried; "you surely do not mean to kill yourself! You would ruin my business! and, besides, it would be a pity to spoil that pretty face!" The lady laughingly replied: "It gives me no pleasure to spoil one of your most beautiful productions, but I will tell you what I mean. My betrothed has deserted me, and I intend to send him a copy of my photograph in this position, with the remark that if he does not return immediately I shall pull the trigger." This astonishing intention was duly carried out, and a few weeks later the photographer had the pleasure of taking the newly married couple without the revolver, which apparently had done its work harmlessly.

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## Correspondence.

### Coloring of Flowers by Absorption.

*To the Editor of the Scientific American:*

In the last number of the SCIENTIFIC AMERICAN, under the heading "Flowers Colored by Absorption," it is stated that "the process of coloring flowers by the absorption of dyes through the stem" is the discovery of Mr. Nesbitt.

Two years ago Mr. C. B. Riker showed me several field daisies colored by placing their cut stems in aniline violet ink. They refused to absorb any color from black ink.

Mr. J. M. Foote, of Newark, made experiments of a similar nature twenty years ago, which are even more curious, inasmuch as he colored peonies as they grew by applying various dyes in solution to the ground in which they stood, obtaining five or six different colors, and also finding them to refuse certain colors.

Both the above experiments probably antedate Mr. Nesbitt's.

DURAND WOODMAN.

South Orange, N. J., September 3, 1883.

### The Locomotive Whistle.

*To the Editor of the Scientific American:*

In your issue of 18th inst., page 99, I notice, with much surprise, your observations on sounds—distances at which locomotive whistles, etc., can be heard. From my own observation I know that the sound of a locomotive whistle can be heard much further than 3,300 yards. Many times, on calm nights, I have heard distinctly the whistle of an engine—locomotive—*seven miles*, air line measurement; and parties of undoubted veracity tell me that they have heard the sound *ten miles* distant. The noise of passing trains on the Weldon road, six miles (10,560 yards) away, is perfectly audible on calm nights. Why, any of our robust negroes could be heard calling hogs, on a calm morning, 3,300 yards distant! and the voices of my students at play during recess have been heard a *mile* from the academy.

This part of North Carolina is very level, and sparsely timbered; this may, perhaps, account for the great distances at which sounds can be heard.

DAVID L. ELLIS,
Principal of Falling Creek Academy.

Goldsboro, N. C., August 28, 1883.

### Novel Spectacles for Near-sighted People.

*To the Editor of the Scientific American:*

Having passed forty, I require to read with comfort No. 11 near-sighted glasses. I can read at six inches without, or at twenty inches with No. 8, but reading and especially writing, is very uncomfortable, so I bought a pair of No. 11 eyeglasses, and for the day it was eyeglasses and spectacles, spectacles and eyeglasses—a regular monkey and parrot time of it. Necessity being the mother of invention, I pressed for a solution and found it. My left eye is so afflicted with myopia that I cannot use any number whatever to advantage, and so call on it only for guard duty, and poor at that. I concluded that this misfortune could be turned to good account by putting a No. 11 glass in the left eye frame and a No. 8 in the right, and "presto!" when I want to look or walk, pop go my eyeglasses proper face forward. When I want to read or write, I reverse the order, and No. 8 goes to my left eye and No. 11 to the right. Result—spectacles are carefully laid aside as mementos of twenty years' faithful service, and I am happy, as I believe many of your readers might be who are likewise afflicted.

M.

Pittsburg, Pa., September, 1883.

### Dollar Weights and Measures.

*To the Editor of the Scientific American:*

It is a duty man owes to his fellow to add to his comforts, conveniences, etc. Accepting this view as correct, I have determined to publish to the world my (I believe) new plan for weights and measures in the United States. By my plan we only need one table in our schools of arithmetic instead of all the various ones now in use. Avoirdupois, troy, apothecaries', land, and other measures and weights will or may be abolished and this one table substituted. Besides, my plan will confine a large amount of business and trade to our own country in the shape of printing, milling, etc. It will save many hours of study to our youths at school, thus enabling them to acquire a more extended education. I suppose the benefits which would accrue would for a long time be almost incalculable. This is not the thought of a moment. It is the result of the study of years. I have consulted some fine minds concerning it, and all approve it.

The plan is to have a certain accurate weight and measurement for our silver dollar. Then everything can be measured by it, and "standard weights and measures," which now cost heavily to Government and the States individually, will be unnecessary. Thus:

| | |
|---|---|
| 10 mills make | 1 cent. |
| 10 cents make | 1 dime. |
| 10 dimes make | 1 dollar. |
| 10 dollars make | 1 eagle. |

Now, ten silver dollars are about 15 inches long; 9½ ounces in weight (av.); 1 ounce of distilled water at 60° Fahrenheit is displaced by 10 dollars. This gives us, viz.:

Measure of length.
Measure of weight.
Measure of capacity.

It being all decimal, the silver coin of the United States can be made to conform to the standard of measures, etc., and we will thus have a uniform standard for weight, measure, and coin, the one being a check on the other.

In the French system there is some danger of error on account of incorrect punctuation. I think that would be avoided in this plan.

The discovery of some better plan than the old one has long been desired, and I believe this plan is all we need.

Suppose we want about a grain of medicine exhibited. There are about 412 grains in a silver dollar. A mill is the one-thousandth of a dollar. Then two mills would represent nearly the weight desired. Suppose we want the weight of a load of coal. If there were 2,000 pounds of coal on the wagon, we would represent that amount by 210 eagles, or, say, 211. Suppose we want to sell a gallon of oil. There are 128 eagles in an oil gallon. We may, if required, add to this nomenclature double eagles, flags, or states, or something to that effect, making use of our own surroundings to designate amounts.

View the question as you may, the decimal system is superior to any, and I believe my system is the best decimal system.

S. HUBBELL.

Lupton, Colo., September, 1883.

### Drawing in the Workingmen's School of Berlin.

BY G. HRABOWSKI.

The object of this school is to furnish apprentices and assistants in every trade, during their spare hours, such instruction in drawing, science, and art as shall supplement the practical part which they learn in the shop.

It opened two years and a half ago with 300 pupils, and last winter had 1,013 pupils with 26 teachers, mostly specialists.

A special class was formed for the apprentices of opticians and instrument makers in mathematics, mechanics, physics, and free hand mechanical and technical drawing. Last October the number applying for instruction in drawing was so large that it was found necessary to start a second class. The number of apprentices receiving instruction was 114, each of which paid 6 marks ($1.44) per semester (half year) for 8 hours a week instruction, which comes out of their own salary.

These gratifying results are largely due to the increasing and judicious endeavors of many master workmen [*i. e.*, the men who have the instruction of the apprentices in the shop] to induce apprentices to go to this school, by directing their attention to the advantages of a theoretical knowledge of their own branch. The idea formerly so prevalent, especially among "self-made" masters, that a theoretical education, on the one hand, only made the young workmen conceited and inclined to expect more, and, on the other, that workmen who think do less work and are of less value, has fortunately been entirely overthrown. Absolute indifference, so great as to be manifest, which cares only for getting the most work out of the apprentice as a labor machine, without regard to whether the latter rises to a useful member of the profession or sinks to a mere factory hand, and which has a still worse effect than the other idea, is now so rarely noticed that we need not dread its influence on the trades.

For constructive workmen drawing is of the greatest importance; it is the application of mathematics. To make something new, to invent something, without drawing, is very difficult, owing to the lack of being able to get a view of it; in fact, it is impossible in making large machines. Engineers and architects could not do half what they do without drawings. Every young man that receives good instruction in drawing will become accustomed to neatness, thoroughness, mathematical habits of thought, a correct and accurate eye, in fact, all good habits that it is important a workman should have, and his dexterity will increase and the taste for beautiful and graceful forms be cultivated. Drawing, which has hitherto received too little attention in the schools, is the very branch of art that is most valuable to the artisan.

The pupils have received such varied previous preparation that it is necessary to give each one personal attention and individual instruction. Class instruction by lectures and blackboard drawing would not be feasible, as less advanced pupils could not keep up and the more advanced would be held back.

The drawings are not made, as is unfortunately still the case in many schools, from other drawings, but from the objects themselves, or from problems given out by the teacher. A mechanical drawing copied from another one, although it is very easy to get nice, clean drawings in this way, is of much less value than drawing from actual models, in which the pupil exercises his eyes more and must use his understanding.

The first drawings that the pupils in the special classes make, after they learn to draw with dividers, are "nets" or sketches of surfaces. The pupils are given the problem of evolving the "net" or drawing the shape in which a piece of foil (or sheet tin) must be cut so as to make a particular object, which has been shown or described to them, with sketches of the correct size of the base, elevation, side, etc.* These exercises are specially suited to the beginner, because he becomes accustomed from the start to mathematical thought in drawing, and also because they can soon be finished, so that his patience is not put to too severe a test, and finally because it gives him an opportunity to learn how to work accurately and neatly with all the drawing utensils, even the brush.

In the second stage of instruction, projections are made, besides the well known projection of a screw, the projection of a curved tripod, and of those parts of an instrument that are placed at acute angles, such, for example, as a lens holder, or a microscope stand, which is specially important for instrument makers. Such drawings are generally made on a large scale to render the construction easier.

In the third class, drawings are made from parts of instruments. First, some metallic object bounded by plane surfaces (turned or filed) is employed, then more complicated parts. They are first sketched free hand, as they will subsequently be drawn; then measurements are made of the model and written on the sketch; then the model is put out of sight, and an accurate drawing made according to these measurements.

Afterward, in the fourth class, complete instruments and apparatus are drawn in this manner, except that the preliminary sketches are omitted to save time, as soon as the pupil has learned to make them correctly and draw from them.

The models used for these drawings are not all "sections," nor such as present to the eye the actual cross section; complicated apparatus themselves are used, which the pupils have to take apart so as to be able to draw the section correctly.

Pupils that have gone over these four stages, which can be done in two semesters (one year), and are able to draw any kind of apparatus, even complicated ones, correctly and neatly, from henceforth draw designs for parts of instruments.

The pupils sketch from memory as many parts of instruments as possible that serve the same purpose, for example, joints, systems of axes, arrangements for adjustment, mountings for lenses, mirror and prism holders, and the like.

After the teacher has directed the attention of the pupil to still other approved constructions for parts of instruments and corrected his sketches if necessary, the pupil will make complete drawings from systematically arranged sketches. Other designs, which are made especially by such mechanicians as make optical instruments, are made by those who have completed the regular course, such as graphic representations of simple optical problems that come before the constructive opticians.

All the drawings are made with black India ink, partially with and partially without shading lines; colors are used only on nets and cross sections. The colored borders so commonly employed in machine drawings are not suitable for this work, where the parts of apparatus are often very fine. Then, too, the color conceals any imperfections in the lines, which is very bad for beginners.—*Translated from the Zeitschrift fur Instrumentenkunde.*

* This experience is also given in Prof. Felix Adler's Workingmen's School in West 54th Street, New York.

### Dangers from Impure Water.

Too much reliance is placed on the senses of taste, sight, and smell in determining the character of drinking water. It is a fact which has been repeatedly illustrated that water may be odorless, tasteless, and colorless, and yet be full of danger to those who use it. The recent outbreak of typhoid fever in Newburg, N. Y., is an example, having been caused by water which was clear and without taste or smell. It is also a fact that even a chemical analysis sometimes will fail to show a dangerous contamination of the water, and will always fail to detect the specific poison if the water is infected with discharges of an infectious nature. It is therefore urged that the source of the water supply should be kept free from all possible means of contamination by sewage. It is only in the knowledge of perfect cleanliness that safety is guaranteed.

The local European volunteer health commission in Alexandria, where the cholera has been raging along back, is unearthing, according to the *Sanitary News*, some very unsanitary conditions in that city. They have found a large native cemetery, underneath which runs a canal, with which communicates a well, the water of which is used to wash dead bodies. A drinking fountain adjoins this well, and the canal is the water supply of a crowded portion of the town. In the mosques are stagnant pools of water used for ablutions prescribed by religious belief, the water in which, being unchanged, gets indescribably foul. Such nuisances are difficult to abate because of religious prejudices. Is it any wonder, adds the *News*, that pestilential disease attacks such a locality?

### A New England Manufacturing City.

The *Maryland Farmer* publishes a letter from a correspondent who has seen the great cotton mills of Fall River, Mass., and gives some statements which are not generally considered when estimating the relative manufacturing importance of the geographical sections of the country. Fall River has a population of 55,000, according to the last census: it has fifty-three mills for the manufacture of cotton goods, covering an investment of $35,000,000. Fall River has over one-seventh of all the spindles in the country, and manufactures over three-fifths of all the print cloths of the country. This manufacturing city employs 18,135 persons, their pay weekly amounting to $113,000, and the capital stock is reckoned at $16,738,000.

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### NEW UMBRELLA SUPPORT.

Umbrellas as commonly made are provided with a central staff and with braces converging toward the staff, the entire arrangement preventing the head from being placed in anything like a central position under the top, and of course the umbrella does not afford the protection it should.

The engraving shows an umbrella provided with a support formed of four rods pivoted to each other at the ends, the upper ends of the upper rods being pivoted to the middle of the umbrella top frame, and the lower ends of the lower rods being pivoted to each other at the handle end of the umbrella support, these several rods being provided with braces and binding rods and locking springs.

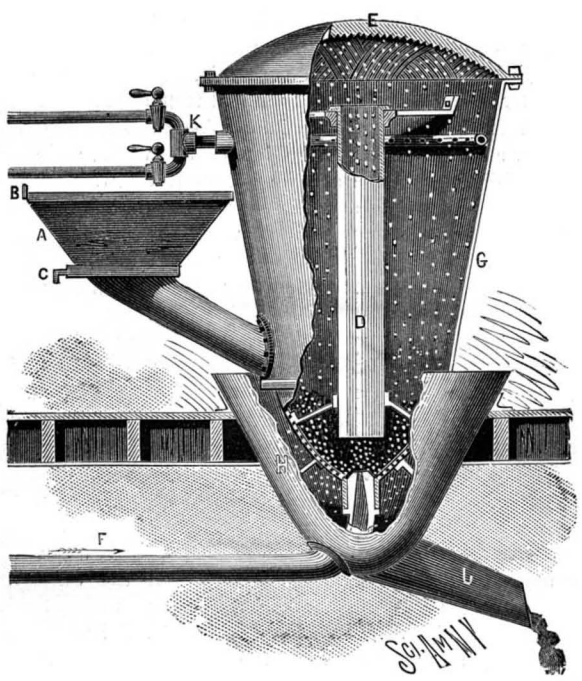
FORSTER'S UMBRELLA SUPPORT.

This arrangement of parts permits of holding the center of the umbrella top directly over the head.

This invention has been patented by Mr. Joseph Forster, of Vienna, Austro-Hungary.

### APPARATUS FOR DISINTEGRATING VEGETABLE SUBSTANCES.

This invention consists in the combination, with a closed vessel or chamber having a perforated bottom or lower portion, of a pipe or trunk supported therein and open at both ends, and a nozzle through which air or steam may be injected to produce an upward current through the pipe or trunk, whereby grain or other material is caused to be repeatedly carried up through the pipe or trunk, and to strike with great force against the top or head of said vessel or chamber, and to fall to the bottom thereof outside of said pipe or trunk. The grain or other material is broken up and disintegrated by striking the top of the chamber, and




GOESSLING'S APPARATUS FOR DISINTEGRATING VEGETABLE SUBSTANCES.

when reduced to a sufficient degree of fineness, is forced by the pressure within the chamber through the perforated bottom or lower portion of said vessel or chamber. The head or a portion thereof may be made separate from the top of the vessel or chamber, and so secured that it may be adjusted nearer to or farther from the end of said pipe or trunk, or removed from the vessel or chamber. There is in the chamber a pipe through which water may be admitted to mingle with the starchy or farinaceous particles and carry the same through the perforated bottom or lower portion of the vessel or chamber.

This invention has been patented by Mr. G. O. Goessling, of Jersey City, N. J.

### The Waste of Water.

The *prevention of the waste* of water already dealt out to the consumers by existing works is a more important subject for investigation than the extension of facilities for still further waste.

According to a report of the city of Milwaukee, it frequently happens that between the hours of 10 P. M. and 6 A. M., when all honest water consumers should be in bed, more water is drawn from the city mains than in any eight hours of daylight. The excess quantity is given as four millions of gallons; this, divided among a population of 115,600, is about 35 gallons per head *wasted*—an amount sufficient for the daily legitimate use of the citizens, and more than is dealt out per day in many English and Continental cities.

In the same report is a startling tabular statement of the quantity of water consumed before and after the introduction of meters. Just why a party should use 203,800 gallons per month when he did not directly pay for it, and should suddenly discover that 5,800 gallons for the same period was sufficient for his needs, as soon as the water was to be paid for *by measure*, is a knotty question to solve. In any other transaction, we should call this abuse of privilege dishonest; he is either robbing his neighbor of water or of money to pay for more water.

"But water costs nothing" is the common opinion and answer of the ignorant and wasteful consumer. It *does cost* fuel and attendance and interest on the general plant, as any one will find out who studies the annual appropriations of his city. In Milwaukee, for instance, the entire system has cost to date $2,374,274; and New York, with 90,000,000 gallons per day on hand to be divided among one and a quarter millions of people, has almost under way a scheme for a further extension of supply, to cost probably twenty millions of dollars.

How to prevent this known waste of water and of cash is a question more easily discussed than answered. The Milwaukee authorities say, force economy by measuring out the daily supply, and if a man will persist in waste, let him pay for his negligence. The present meter system seems to us certainly the best adapted to meet the difficulty in the case of mills and large factories where the greatest individual misuse of water is located. But what are we to do with our dwellings? Even though the waste may be small in each, the aggregate swells to an enormous total!

The vents for water in the distributing system of a large city are almost countless, and to protect them all against abuse is an exceedingly difficult contract. A very respectable percentage of water pumped in most cities finds its way into the ground or adjacent sewers, through leaking joints in the mains. The waterphone of recent introduction has been the means of discovering and having repaired some alarming waste from this cause; and it has also been utilized in checking abuse among consumers.

The average user of water cannot be reasoned with; he must be forced to a proper economy; and he who will suggest the best means, and the best method of putting into practice his suggestions, will be deserving of the unbounded thanks of all taxpayers, and he will put money in his purse as well.

The intermittent or tank-system of England will not answer; it has many objectionable features, and among the most serious is the fact that users will not properly clean them, and hence the tanks become breeders of disease, instead of dispensers of nature's most precious fluid.

We measure out gas in every house, and though the supply becomes more complicated in the case of water, we must ultimately resort to universal metering. With present experience, we see no other way of putting a stop to the waste of public money now going on in all our larger cities, in providing further food for waste; the evil grows in proportion to the supply.

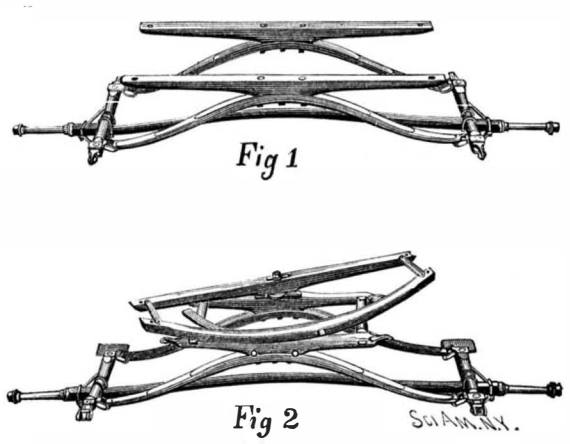
There is a certain sentimental dislike to the limitation of an individual water supply that is as groundless in fact as it is expensive in application; it must be resolutely cast aside. When sifted the problem is one in which all have a vital interest, though few seem to realize it.—*Engineering News.*

### Food and Brain Work.

An organism which is doing brain work as well as muscular work requires higher and better food than an organism in which the brain is comparatively idle and only the lower centers and the muscles do much work. Undoubtedly the effect of brain work is to strengthen the brain and to render it less likely to become abnormal in its structure or disorderly in its activity than if it were idle. Such exercise as the brain receives in education, properly so-called—that is, development of the faculties—stimulates nutrition, and in so doing increases the need for food. Excessive activity with anxiety is not good at all, and ought to have no place in the educational process. Worry is fatal to good work, and to worry the growing brain of a child with work is to maim and cripple its organization, doing irreparable, because structural, mischief, the effects of which must be life-long. "Tension" in work is not a proof of strength, but of weakness. A well developed and healthy grown brain works without tension of any kind. The knit brow, straining eyes, and fixed attention of the scholar are not tokens of power, but of effort. The true athlete does not strain and pant when he puts forth his strength. The intellectual man with a strong mind does his brain work easily. Tension is friction, and the moment the toil of a *growing* brain becomes laborious it should cease. We are, unfortunately, so accustomed to see brain work done with effort that we have come to associate effort with work, and to regard "tension" as something tolerable, if not natural. As a matter of fact, no man should ever knit his brow as he thinks, or in any way evince effort as he works. The best brain work is done easily, with a calm spirit, an equable temper, and in jaunty mood. All else is the toil of a weak or ill developed brain straining to accomplish a task which is relatively too great for it.—*Lancet.*

### IMPROVED PLATFORM GEAR FOR WAGONS.

We give an engraving of an improved platform gear for wagons recently patented by Mr. William S. Appleget, of Cranberry, N. J. Fig. 1 shows the rear axle with its attached springs, and Fig. 2 shows the forward axle. The bars to which the rear end of the wagon body are to be attached are secured to half-elliptic springs whose ends are




APPLEGET PLATFORM GEAR FOR WAGONS.

suspended by links from bars resting transversely on the axle. The front axle is similarly arranged, and the fifth wheel is supported on the cross-bars, the king-pin being carried by the forward bar, and the wear plates by the rear bar.

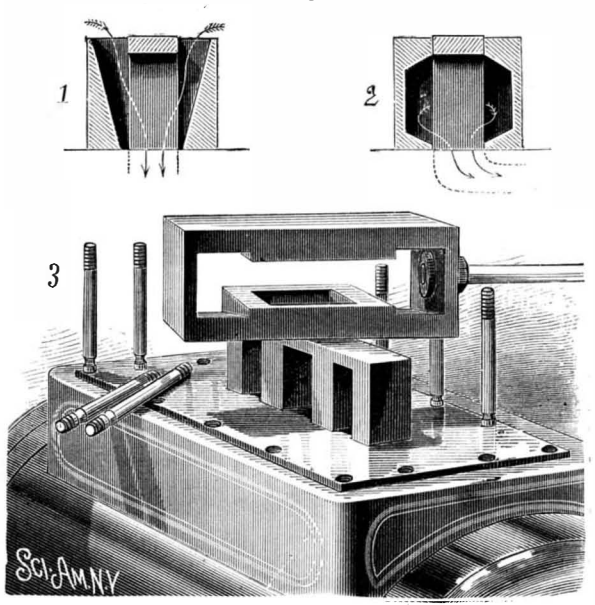
This arrangement insures great firmness and security to the gearing of platform wagons, and admits of the use of the best form of spring.

### NEW BALANCED SLIDE VALVE.

The annexed engraving exhibits a new form of slide valve designed to obviate the friction caused by steam pressure on the valve. Fig. 1 is a transverse section taken through the supply portion of the valve. Fig. 2 is a transverse sectional view taken through the middle of the valve, showing the exhaust cavity, and Fig. 3 shows the valve seat and the complete valve in perspective, but separated from each other.

The face of the cylinder on which the valve slides is formed at its center with the raised portion or projection, of a length and width for covering the openings to the steam and exhaust ports, and this projection or cover is formed with transverse slots or ports which are continuations of the usual steam ports, so that they open to the steam chest at the sides of the projection.

The valve is substantially two bridge valves yoked together and fitted to the opposite sides or faces of the seat. The two sides of the double valve, are connected at their ends by cross bars. The middle portion of each side is formed




TAYLOR'S BALANCED VALVE.

with an exhaust recess, and near to their ends the sides are cut out to give space for the access of steam to the ports.

It will be seen that with this double valve fitted in the manner described on the projection of the valve seat the steam pressure is equal upon each side of the valve, and the pressure of steam is sustained by the material of the valve. There is therefore no pressure of the valves upon the side faces of the valve seat on which they work. There is another advantage in the double ports and valves, as at the first movement of the valve in opening the ports the port at each side is opened, so that double the amount of steam is admitted.

For further information, address Messrs. C. F. Taylor and J. D. Young, Sacramento, Cal.

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### THE DEMOISELLE AND PEACOCK CRANE.

The demoiselle crane is found in Central Asia, Middle and South Africa, and sometimes in Eastern Europe. The plumage of this beautiful bird is a blue gray, the front part of the neck is black, and it has snowy white ear tufts; there is also a tuft of long, flowing black plumes hanging from the breast, the wings are grayish black, the eye bright carmine, the bill at the root a dull green, but toward the point it is the color of horn; the feet are black. The ornamental feathers of the head and breast are lacking in the young bird.

The movements of this bird are generally slow and dignified; it only hastens and runs in cases of necessity. It raises itself easily from the ground by one or two bounds, gains the requisite height by a few strokes of its powerful wings, and flies with its head and legs stretched out straight from its body. But this bird often acts in the most singular manner, dancing on the tips of its toes, nodding its head, and flapping its wings in a grotesque fashion. In exuberance of spirits it sometimes takes little stones and pieces of wood from the ground, throws them in the air, and tries to catch them again, dancing and springing and running hastily to and fro; but it is always graceful and beautiful.

These birds are very cautious, and it is a difficult matter to outwit them or take them by surprise. The single bird thinks only of its own safety, but a company of the birds post regular guards, upon whom devolves the care of the flock. If they are disturbed, they send out spies to reconnoiter before they approach again the spot where they were frightened.

about two hours; then it goes to the sand banks in the stream to drink and dress its feathers. Sometimes it makes a short excursion for food in the middle of the day, but generally the morning meal satisfies it for the whole day. Toward evening the flock divides into smaller groups, and they fly away to their sleeping place.

These beautiful and remarkable birds are often tamed in the western part of Africa and sent to Europe. One writer saw one of these birds running around the streets of Lisbon. Bread and other food was thrown to it, and it had become so accustomed to these gifts that it plainly demanded them.

In zoological gardens visitors are attracted to their cages because they almost always begin to dance as soon as they hear the music. Their height is about four feet.—*From Brehm's Animal Life.*

### Glass from Granulite.

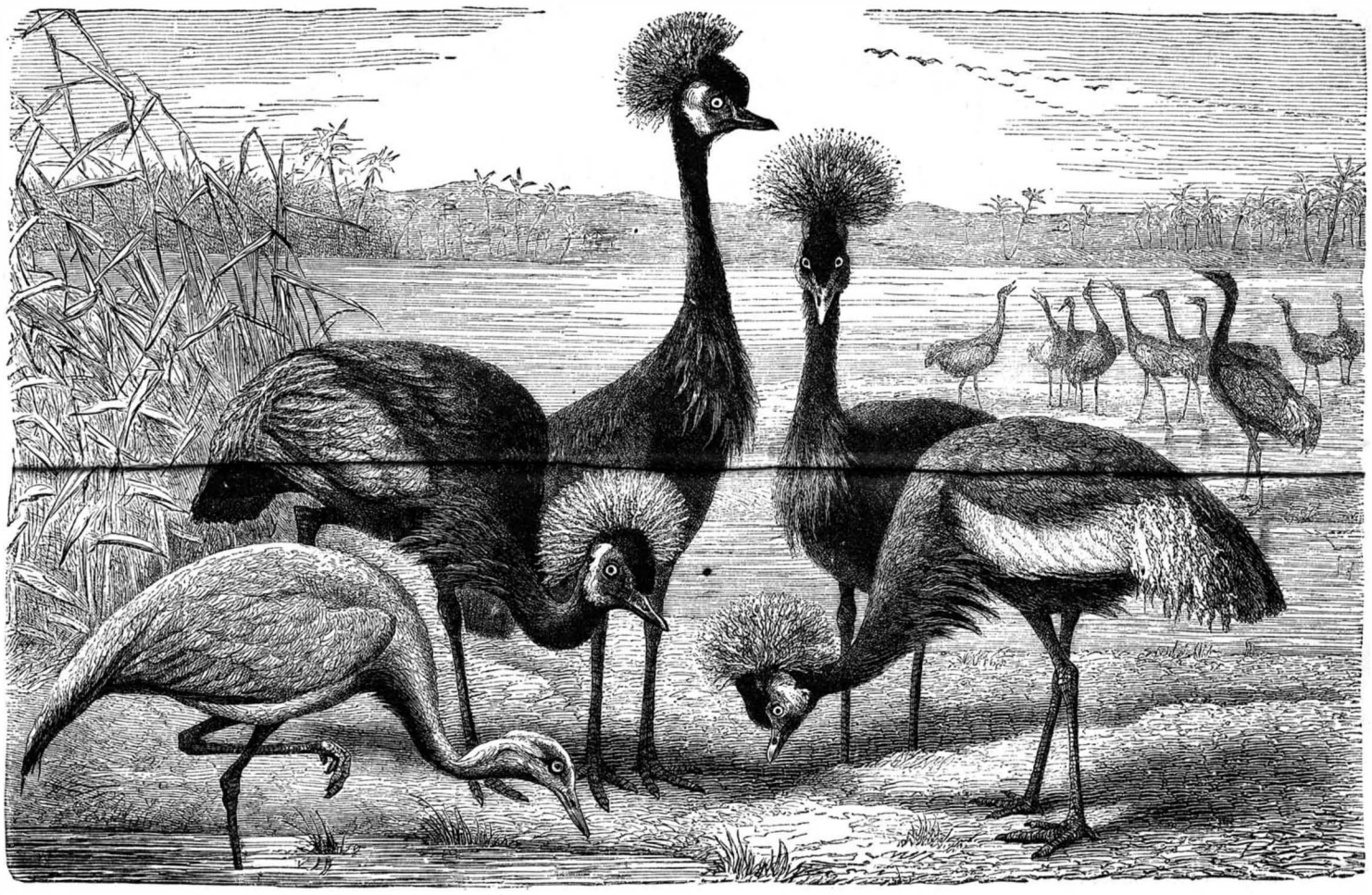
The manufacture of "pale metal" glass from the rock known as granulite has been carried on successfully by F. Siemens at Dresden, Saxony, and at Elbogen, Bohemia. The superiority of the glass and the great economy of production have secured to him a very large share of the bottle trade of the Continent; the output of his works during the year 1880 having been about twenty-two millions of bottles, which has since nearly doubled in number annually.

It is now proposed to establish works in England to manufacture glass extensively from a deposit of granulite which has been discovered at Meldon, Devonshire, and using the Siemens process. Mr. Siemens, to whom a sample was sent, that the deposit at Meldon has been examined by W. F. Rutley, F.G.S., who finds it to be in quantities sufficient to supply any likely demand for glass manufacture in England for the next thirty years. It is proposed to put up the works at Swansea, and to connect the quarry at Meldon by a siding with the London and Southwestern railroad system—by which the granulite will be taken to the port of Fremington, to be sent thence by water at small cost to the works at Swansea. The advantages of this location rest in cheap coal, limestone, and labor, with works already built, excepting Siemens' continuous melting tanks, which are to be added, a license having been obtained from Sir William Siemens. The company proposes to make not only bottles in large numbers, but glass castings, as substitutes for woods and metals. Among other articles, millstones, gas and water pipes, and even railroad ties are enumerated.

These facts should stimulate a search in this country to determine whether deposits of magnitude of suitable granulite are favorably located for transportation to make their development practicable and profitable.—*Eng. and Min. Jour.*

### Salt for the Human System.

The London *Lancet* combats the folly of some would-be improvers on Galen, who decry the use of salt as a food condiment because it is a mineral. The *Lancet* says that common salt, chloride of sodium, is the most widely distributed substance in the body; it exists in every fluid and in every solid; and not only is everywhere present, but in almost every part it constitutes the largest portion of the ash



THE DEMOISELLE AND PEACOCK CRANE.

Although this bird is so cautious when free, in captivity it attaches itself to its keeper.

It subsists upon grain, seeds of various kinds, and also eats grass and young plants. It captures worms and insects, especially beetles. In thickly populated India, where grain is of much value, the cranes that pass the winter there are considered very injurious birds, and are looked upon with jealous eyes. They are often pursued and driven away. The demoiselle crane is about three feet high.

The peacock crane (Balearica pavonia) is black, the crown golden yellow and black mixed, the wing coverts pure white. The cheeks are scarlet, the bill black, white at the point. The foot a grayish black.

The native country of these birds is Central Africa; they are found upon the shores of streams, and during the rainy season may sometimes be seen in companies of a hundred.

Its gait is stately; it holds its crown erect. As a rule it walks slowly, but it can run very swiftly.

When about to fly, it runs along on the ground for a short distance with spread wings and then rises in the air. Its flight is slow, the wings move with measured strokes, the neck is stretched out, and the crown laid back.

Like the demoiselle crane, this bird occasionally indulges in fantastic gambols, springing sometimes a meter from the ground, spreading its wings, and dancing about. Its voice is very loud, sounding something like a trumpet. It eats seeds, especially the seeds of a kind of grass, also insects, mollusks, and small fishes.

The daily life of the peacock crane is very regular. From its sleeping place it goes out upon the plain at the rising of the sun in search of food, where it remains generally for

wrote approvingly of the quality as follows: "The small piece of granulite seems everything we could wish for. If that kind of stone is to be found in large quantities, and of a uniform character, and easily to be got, it might prove quite a treasure, as it consists almost exclusively of silica and alkaline matter, with perhaps 15 per cent of alumina and but little iron."

These are the essential qualities of granulite for glass making. The rock is generally classed as a member of the granite family. It consists mainly of quartz and orthoclase feldspar, and is either granular or schistose. It is sufficiently rich in the alkalies to fuse and to make a pale green glass, if a little lime is added sufficient to secure a perfect fusion of the quartz. The rock is nearly white, and in fact is known by the Germans as *Weiss-stein.* It should not contain much iron; the Saxon variety does not contain over 0·71 per cent. Similar rock, or rock which would serve equally well for the manufacture of glass, is found in Canada and in California, and probably in New England.

The economy in the use of the rock over the use of the ordinary sand and alkali is shown by Mr. Siemens, who states that, at his works in Dresden, the batch for ordinary green glass with granulite costs 8d. per hundredweight, and gives 93 per cent of glass; while the batch with sand costs 13d. per hundredweight, and yields only 67 per cent of glass; consequently glass from granulite costs only 8½d. per hundredweight, while that from the sand batch costs nearly 20d. or more than double, if calculated upon the glass. There are, besides, advantages in favor of the granulite in respect of fuel, labor, and wear and tear of furnaces.

In the prospectus of the English company, it is stated

when any tissue is burnt. In particular it is a constant constituent of the blood, and it maintains in it a proportion that is almost wholly independent of the quantity that is consumed with the food. The blood will take up so much and no more, however much we may take with our food, and, on the other hand, if none be given, the blood parts with its natural quantity slowly and unwillingly. Nothing can demonstrate its value better than the fact that if albumen without salt is introduced into the intestines of an animal, no portion of it is absorbed, while it all quickly disappears if salt be added. The conclusion therefore is obvious that salt, being wholesome, and indeed necessary, should be taken in moderate quantities, and that abstention from it is likely to be injurious.

### Ocean Rafting.

A raft of timbers intended for spiles was brought from St. John, New Brunswick, to New York city August 26, after a voyage by steam tows of three weeks. The distance is 600 miles, an average of 60 miles per day. The raft, if such it can be called, was 800 feet long and 30 feet wide, drawing about eight feet of water. It was formed by sections of eleven cribs each, containing about 500 spiles of sixty-five feet length. Over and around the sections great chains were wound. Between each cargo there was a wide space to allow free working of the raft in a rough sea. The cargoes weigh about 250 tons each, and it would have cost about $25,000 to bring them to New York by sailing vessels, as the boats engaged in this kind of transportation demanded extra pay on account of the size of the raft. The raft was towed by two powerful tugs.

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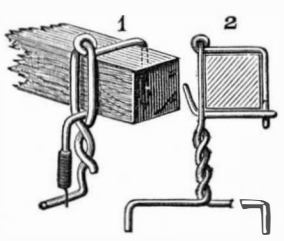
## RECENT INVENTIONS.

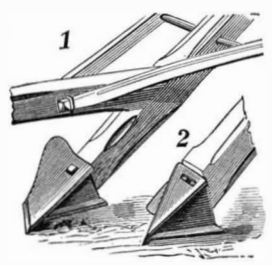
### Worline's Clamp Device.

This simple contrivance is designed for fastening a weed and grass turner or a colter to the beam of a plow, and it may be adapted as a splice clamp for beams and other objects required to be clamped together. Different parts of the clamp can be extended in various directions to form various useful devices, such as a weed turning extension for bending over and turning down the weeds and grass in advance of the plow mould board, to cause them to be more effectually and completely covered in the furrows. This device is made wholly of round iron, is very readily applied, and is inexpensive. The engraving shows the construction of the device very clearly. Mr. Chauncy E. Worline, of Prospect, O., is the patentee of this invention.



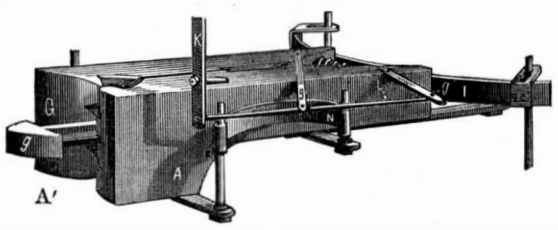

### Landside for Plows.

This invention is designed to increase the strength and durability of plow plates, and obtain the efficiency and steadiness of ordinary turn plows without their weight. It consists in a landside for plows made with a slotted flange to rest upon the forward side of the plow standard, and a flange to rest upon the bottom of the furrow, so that the plow will be made stronger, more durable, and more effective, and will be made to run steadier. This invention has been patented by Mr. William B. Wherry, of Overton, Texas.




### Car Coupling.

The danger attendant upon coupling in the usual way has prompted inventors to provide some means whereby this work may be accomplished as safely as ordinary railroad work. The devices shown in the engraving are designed to accomplish this work with safety. A A′ are coupling jaws hinged together at *a*. Their forward ends are cut away on their inner surfaces to form coupling hooks, and are cut away to form openings between the jaws for receiving the head of the connecting link, G. The rear ends of the jaws extend past the hinge, *a*, and have a coiled spring placed between to keep the forward ends closed except when they are opened for uncoupling. To open the jaws the rear ends are provided with connecting bars, *g g′*, which connect with a lever on the under side of the car body. This lever is operated by the hand lever, K, pivoted to the platform of the car. The jaws are formed with slots, through which bolts pass for securing them to the car, and back of the jaws is placed the spring, I, which acts as a buffer spring to relieve the car from shock. Outside of the jaws are placed the coupling springs, N, which press against the jaws and hold them firmly, except when they are acted upon by the lever for uncoupling the cars. The link, G, is of the form shown in the engraving, made with heads, *g*, side fins, and a center piece or stop. The fins are beveled so as to fit in the openings formed in hooked front faces of the jaws. With the link, G, no bolt is needed, as the shape of the heads keep it in its place, but if an ordinary link is used, a bolt, may be used by passing it down through the opening in the jaws behind the hooks. This coupling has been patented by La Vega T. Williams and Edwin D. Knight, of Poseyville, Ind.




### Artificial Stone as a Building Material.

The high antiquity of prehistoric remains is frequently authenticated by the presence of the "sun-baked bricks" found among them. The *Encyclopædia Britannica*, in an article on St. Jean d'Acre (a town and seaport in Syria, and in ancient times a place of some celebrity), says: "Its great antiquity is proved by fragments of houses that have been found, consisting of that highly sunburnt brick with a mixture of cement and sand, which was only used in erections of the remotest ages."

In Scotland, Ireland, and Wales it has been found that the most durable material of those old "castles of the gallant clans" is concrete, in which small cobble stones were embedded to form a solid piece of masonry.

The Moors have left samples of their artificial stone inwrought upon the rock of Gibraltar, which have withstood successfully the storms of ten centuries. The Colosseum at Rome presents further examples which have nobly resisted the tests of time; the cisterns of Solomon, near the city of Tyre, which are of still higher antiquity, are almost complete in their preservation; and at Jerusalem there are to be seen five immense courses of Cyclopean masonry, the base of the wall of the city (now inclosing the Mosque of Omar), supposed to be a remnant of the wall of the Temple of Solomon, which, as the record tells us, was "set in its place *without the noise of the hammer and the ax.*"

Scientists have suggested that the Pyramids were mainly built of artificial blocks, manufactured upon the spot, from the sands of the surrounding plain, by some cunning process which has perished with the builders; and travelers have claimed that the Diocletian or "Pompey's" Pillar, and the ruins of Baalbec and Palmyra, are mainly of artificial stone. Whatever may be said of these, we have in the actual measurements of the enigmatical "coffer" in the king's chamber of the Great Pyramid indubitable evidence of its original plasticity. In the first place, we find it depressed upon all its sides, from the corners toward the center, and *unequally* so. The east side of the coffer has been sadly mutilated by tourists, the southern corner being chipped away about two-fifths its height. The mean depressions are at the north end 0·26 inch, at south end 0·19 inch, at west side 0·20 inch, and at east side 0·01 inch. They are observable vertically as well as horizontally. At the south end of the west side there is no depression perceptible; while at the north end of the same side the depression is 0·20 inch, and on the south end, at different distances from east to west, the depressions are 0·08, 0·12, and 0·14 inch. Upon all sides the coffer is highly polished over all these inequalities. Now, no one acquainted with the simplest means of working natural stone would look for these inequalities, and for the corresponding *bulging out upon the inner surfaces* which we find to exist.

The square, the plummet, and the rule would have done their perfect work before the polishing, and if the depressions had been *intentional*, they would have been *regular*. Again, if we take the superficial outside measurements of the coffer, we find the same irregularity. On the east side near the bottom we have a length of 90·5; ten inches below the top, 90·15; on the top, 90·20. On the west side near the bottom, 89·2; near the top, 89·95; at the top, 90·05; mean length, 90·01. At the north end near the bottom, 39·05; near the top, 38·7; at top, 38·67. At south end near bottom, 38·8; near top, 38·6; at top, 38·5; mean width, 38·72. From all which we argue that the coffer was moulded in its present position from plastic material, and that it became thus slightly warped, or shrunken, as it dried—in short, that it is of artificial stone, and not of "porphyry," of "black marble," or of "a darkish variety of red and possibly syenitic granite," as has been variously asserted.

Coming down to a later period and a little nearer home, we have in the city of Santo Domingo some of the most interesting historical monuments of this material. This is the oldest existing settlement by white men in the New World, being founded by Bartolommeo Columbus in 1494. Although built on a solid limestone formation, the city is surrounded by a wall of artificial stone, eight feet thick, built (in 1506) of *mamposteria*, "a composition of earth, powdered stone, and lime." Many of the more ancient houses and public buildings of the city, constructed of this material, are still standing and are remarkable for their solidity; the cathedral, especially, in which the remains of Columbus and his brother Bartolommeo reposed for two and a half centuries, which was begun in 1512 and finished in 1540; while on the opposite bank of the river the so-called "Castle of Columbus," a fortified stone house subsequently built by Diego Columbus, the son of the great admiral, is in ruins.

The Vanne Aqueduct, in France, is another example. Gen. Gillmore characterizes this as "the most important and costly work that has yet been undertaken in this material," being thirty-seven miles in length. This aqueduct, which supplies the city of Paris with water, traversing the forest of Fontainebleau its entire length, comprises two and a half to three miles of arches (some of them as much as fifty feet in height), eleven miles of tunnels, and eight or ten bridges (from seventy-five to one hundred and twenty-five feet span) for the bridging of rivers, canals, and highways. The smaller arches are half circles, and are generally of a uniform span of thirty-nine feet four inches, with a thickness at the crown of fifteen and three-fourths inches. Their construction was carried on without interruption through the winter of 1868–69 and the following summer, and the character of the work was not affected by either extreme of temperature. The spandrels were carried up in open work to the level of the crown, and upon the arcade thus prepared the aqueduct pipe was moulded of the same material, the whole becoming firmly knit together into a perfect monolith. The construction of the arches was carried on about two weeks in advance of work on the pipe, and the centers struck about a week later.

The lighthouse at Port Said, in Egypt, is another interesting structure of this material. It is one hundred and eighty feet high, without joints, and rests upon a monolithic block of the same material containing nearly four hundred cubic yards.

An entire Gothic church, with its foundation walls and steeple in a single piece, has been built of this material at Vesinet, near Paris. The steeple is one hundred and thirty feet high, and shows no cracks or other evidences of weakness. M. Pallu, the founder, says that "during the two years consumed by M. Coignet in the building of this church, the material in all its stages was exposed to rain and frost, and it has perfectly resisted all variations of temperature."

But we have upon our own shores a building antedating these structures nearly thirty years. This is the residence of the late George A. Ward, Esq., at New Brighton, Staten Island, familiarly known as "the cement house," built in 1837, and ten times more solid to-day than the day it was erected. There is no more exposed place to test the stability of this material than the north shore of Staten Island, where this building stands. We confess to some misgivings as we approached it last summer, not having seen it for about thirty years, but we left it more than satisfied, and to such of our readers as require the test of Thomas the doubter, we commend a pleasant trip over the Bay of New York, and a personal inspection.

Another building is the residence of Wm. E. Ward, Esq., at Portchester, N. Y. This is beyond doubt the most expensive private residence of the kind yet erected in this country. It is a perfect monolith, from the lowest line of the cellar wall to the top course of its towers, and is a monument at once of the enterprise, taste, and munificence of its proprietor, a monument, too, which is likely to endure when some other monuments have crumbled in decay. A full description of this building was given in the *American Architect* of August 17, 1877, and a further description was read before the American Society of Mechanical Engineers, at their recent meeting in the city of Cleveland. Perhaps the severest tests to which the material has ever been subjected were in the great Chicago fire of 1871. While granite was chipped and splintered into fragments, while limestone was reduced to powder, while sandstone was disintegrated, and iron twisted into fantastic shapes, artificial stone alone remained intact, and was in shape to be immediately relaid. Several instances could be given, conspicuous among which, however, is the front of the store 114 Monroe Street, which, although thrown down by the failure of its iron supports, was taken up, stone by stone, and relaid. Many of the stones were placed in their original positions; some few were fractured by the fall, and had to be replaced by fresh ones, but none were disintegrated or fractured by the fire, and all were utilized. The front stands to-day exactly as it did before the fire.

The architect is often required to manage a sea wall or a cellar wall where the action of water is to be considered in connection with the safety of his superstructure. And here we claim the vast superiority of this material. In basements it will be found not only waterproof, but *rat proof*. The United States Government has recently employed it as the base of a lighthouse in the Chesapeake, where heavy masonry had proved inadequate, and they would have done better if they had followed the example of the French Government in the construction of the lighthouse at Port Said, and constructed the whole building of the same material. As a sea wall, the jetties of the Mississippi are perhaps the best example we have in this country. When we consider that this great river is the outlet of twenty of our States and Territories, covering an area of 750,000,000 acres—the granary and the principal cotton producing region of the world—the importance of these jetties cannot be overestimated And hand in hand with their far-reaching commercial value is the triumph they have so signally achieved for artificial stone; for it must be conceded that without this element of success, the jetties would have been a failure. Indeed, they had already proved so, and in less energetic hands they might have been abandoned. The jetties themselves, primarily jets or projections of wicker work, anchored in place and secured in position by rubble and heavy stone, proved inadequate to resist the easterly storms that sometimes prevail, and it became evident that some further protection of the work was required. Heavier stones, some of them weighing three thousand pounds, were accordingly and with great difficulty anchored upon the jetties; but these proved also insufficient. Resort was now had to monolithic masses of artificial stone, and they have proved successful where nothing else could; some of the blocks being thirteen feet in width, five feet thick, and fifty-five feet long, and weighing more than two hundred and sixty tons. One mile of the east jetty and half a mile of the west were thus effectually protected, and so complete were the appliances employed upon the work that it required only the hands of two men to mould them and place them in position.

The jetties at the mouth of the Suez Canal are of a cheaper quality of beton, and are not monolithic, the blocks weighing only about twenty tons; but they are sufficient for the purpose, eighteen thousand of them being employed in the work.

From the description we have given, the far-reaching utility of this material is quite palpable. Its durability is established beyond cavil, and it has the approval of the most eminent architects and engineers of both hemisperes. While other material is constantly undergoing disintegration and decay, this as constantly improves by age. In the air, in the water, in the fire, and in fact under all imaginable circumstances, the certainty of using it with success is one of the greatest of its recommendations.—*H., American Architect.*

### A New Bisulphide Engine.

What is represented as a successful attempt to utilize the bisulphide of carbon to drive a steam engine is described in the Lowell (Mass.) *Daily Courier*, of August 13. With the engine and heater in use the improver, Mr. W. S. Colwell, gets an expansive force of 51 pounds per square inch at the heat of 212°, which in the steam engine, with vapor of water, is *nil*. The claim is made for this motor that the objections heretofore urged against the use of bisulphide of carbon are all removed by Mr. Colwell's methods, which have been carried beyond the experimental stage.

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### ENGINEERING INVENTIONS.

Messrs. S. H. Knapp and A. E. Adams, of Danbury, Conn., have patented a novel and ingenious elevated wire railway for carrying mail, dispatches, etc. Small cars run on wires which are supported on posts in the same manner as telegraph wires. The cars are propelled by a small electro-motor which receives its electric current from a battery on one of the cars.

A device for operating air compressor valves which obviates the necessity of employing spring valves, which are apt to get out of order and which enables the cylinder to be more properly filled, has been patented by Mr. Charles A. Bennett, of Dover, N. J. This device opens and closes the inlet valve of the compressor automatically, and is operated at the same time by the machinery of the compressor.

Mr. Joseph Torras, of Red River Landing, La., has patented an improvement in levees for preventing low lands from inundation, and which are built in sections, consisting of metal plates having one end set in the earth and supported in an inclined position by a suitable frame. The invention consists of a supporting frame combined with the inclined and partially embedded plates, and consisting of a base having uprights and inclined bars secured to the uprights and to one side of the base.

An improvement relating to stock cars, and consisting in devices for facilitating the watering and feeding of the stock, has been patented by Mr. James C. Weaver, of Cutler, Ind. In this car spring racks are arranged along the sides which receive the hay as it is stuffed through openings in the sides, and which when the hay has been consumed are closed up by springs and thus do not occupy the space of ordinary hay racks. The car is likewise provided with a partition which is arranged to be suspended from pivots at different points in the car.

### MECHANICAL INVENTIONS.

Mr. Oakley S. Walker, of Carthage, N. Y., has patented a ratchet drill having the working lever provided with a boss or socket which forms a bearing for the feed mechanism, whereby the feed mechanism may be extended and utilized the full length of the drill spindle.

Mr. Erastus B. Barker, of New York city, has obtained a patent for an improved manner of mounting a photographic camera box upon a circular support; the object of the invention being to enable the box to be readily reversed and adjusted to any desired position, so that pictures of different horizontal and vertical lengths may be taken.

Mr. J. M. Matthews, San Antonio, Texas, has received letters patent for an improved apparatus for destroying insects. A furnace is provided in which obnoxious substances such as sulphur are burned, the fumes of which are forced into the ant or mole hole by a machine connected with the furnace. In this way the ants or moles are either destroyed under the ground or are driven out of their holes, when they can be easily disposed of.

An improvement in the manner of connecting the escapement of a clock with the pendulum rod, and which serves to lessen the friction in the pendulum action of the clock, has been patented by Mr. John Blanshan, of Le Fever Falls, N. Y. A pin on the rod of the pendulum strikes a notched lever and gives it a back and forth movement, while by a similar movement of its lower end the verge is caused to operate the escapement wheel.

A device for removing piston rods from cross heads has been patented by Mr. James E. Worswick, of Montgomery, Ala. This invention is designed for the purpose of removing piston rods from cross heads without the injury of any part, and it consists in a base piece having a threaded projection, provided with a bore, and a cylinder formed with an internal nut screwing on the projection and connected to the cylinder by feathers and adapted to bear against an annular shoulder in the cylinder.

A patent has been granted for a mechanism for raising lines to the upper parts of buildings to enable ladders or other escape mechanism to be elevated in case of fire. This mechanism is designed to be clamped to the top of a ladder or telegraph pole, and by manipulating the crank a long rod bearing one end of the rope at its extremity will be elevated until the window or roof from which the people are desiring to escape has been reached. Mr. George O. Daw, of New York city, is the inventor of this device.

A machine for preparing batches for glass furnaces, and also for promoting thoroughness in the preparation of such batches, has been patented by Mr. George S. Crotts, of Philadelphia, Pa. The invention consists in a batch mixer constructed with a series of elevators, and a box and a discharge slide, and spouts for introducing the material into the mixing cylinder, where it is thoroughly mixed and then discharged upon the screen, so that the material will be mixed and screened with one handling.

Mr. Benjamin E. Sergeant, of Greensborough, N. C., has obtained a patent for an improvement in the manner of adjusting logs to the saw in saw mills. In this invention the log may be adjusted on the carriage in such a way that either end may be approached to the work separately, or both ends may be moved forward with an equal adjustment. The machine is so constructed that the workman, without moving from his position, may attend to the adjustments of the different parts, the setting of the log beams separately or together, the reversal of the movement of the log carriage, the adjustment of the saws, etc.

A very cheap, durable, and convenient handle for carboys and other vessels has recently been patented by Mr. Fred. A. Howard, of South Easton, Mass. The handle may be made in the form of an oblong loop of a convenient shape for the hand, and is terminated in a ball which fits within a cup-shaped socket, thus forming a ball and socket joint. With this construction the carboy may be readily carried by one person, and at the same time, if it be rested by the handles on any suitable support, the contents may be drawn out by simply tipping the vessel forward.

An automatic egg boiler has been patented by Messrs. William P. O'Brien, of San Jose, and Walter B. O'Brien, Jr., of Santa Clara, Cal. This invention consists of a dish made to set in a boiler on a spring that is held in check by a catch to be tripped by a spring power time train of gears that may be set for running the length of time the eggs are required to boil, and is provided with means for tripping the spring at the proper time. This spring pushes the egg dish up out of the water, and thus automatically takes up the eggs at the precise predetermined time, and insures the cooking of the eggs to the required extent.

Mr. Norton A. Ellis, of Boonesborough, Iowa, has patented an improved siphon faucet in which the pump for withdrawing the air from the faucet is located on the top of the faucet cock, which has a passage that opens from the siphon to the pump, when the main discharge passage through the cock is closed. The pump has a discharge pipe which swings into position over a receptacle in the nozzle of the faucet, for the discharge of the liquid that may escape from the pump into the nozzle when the passage from the siphon to the pump is open, making a simple and efficient siphon faucet having only one cock or handle to manipulate.

It is a great advantage in laying tin roofs to shape the tin and prepare everything that is possible in the shop, as any work can be done there more handily, rapidly, and more thoroughly than on the roof. Mr. Robert C. Snowden, of Elizabeth, Pa., has patented a machine for bending the edges of the sheets of tin, so that they may be joined upon the roof. The machine is provided with a folding bar or brake, and with a bending plate hinged so that it may be swung down upon the edge of the table, and thus bend over the edge of the tin for the purpose described. This invention is an improvement upon a patent granted to same inventor in March, 1883.

An improved saddler's sewing horse has been patented by Mr. Joel Thomas Ward, of Piedmont, W. Va. The invention consists in a sewing horse constructed with a fixed jaw and a pivoted jaw connected by a spring, the lower end of which pivoted jaw is connected by a connecting rod with an arm of one end of a pivoted foot lever, which can be locked in position by passing the edge of a plate on the lever under the teeth of a rack secured on one of the legs. A rod provided at its upper end with a hook bend passes loosely through the bench, and can be locked in the desired position by means of a suitable binding screw, which rod serves to support the work.

A cotton cleaner and feeder for removing sand, stones, leaves, and other refuse from seed cotton previous to ginning, has been patented by Mr. A. J. Williams, of Macon, Ga. This saves the labor of picking stones from the cotton by hand, which is necessary when it is cleaned only by a fan. As the cotton passes from the feeder it is carried between the beater and the apron, which operation loosens the cotton and permits the stones and sand to fall through openings prepared for the purpose in the apron. The cotton then passes into a trunk, when it is carried up by a fan over a suitable roller, while the stones and heavy refuse pass down and collect in a suitable receiver. The same inventor has further secured a patent for an improved rib for cotton gins to prevent seeds and other refuse from collecting in the space between the ribs and preventing the proper action of the saws. This improved rib is beveled on the front side and the opening is flared forward toward the upper end, so that the faulty seeds and lint are allowed to slip up and out, thus keeping the space clear and free.

### AGRICULTURAL INVENTIONS.

Mr. G. A. Merriam, of Sharon, Wis., has patented an improved hay fork, which consists of two arms hinged together and provided at their outer ends with pivoted tines, which are held in place when in the hay by latches or triggers fitted upon the arms of the fork.

A combined cultivator and planter has recently been patented by Mr. John B. Newsom, of Near Eufaula, Ala. This implement is provided with a plow at the front for opening the furrow, and with a hopper and a star-shaped wheel located within the hopper for regulating the distribution of the seed in the furrow, and it is further provided with two pairs of plows at its rear end, which serve to cover up the furrow when the seed has once been deposited therein. One plow of each pair may be detached in case one horse is to be used and it is necessary to lighten the draught.

An improved grain separator has been patented by Mr. William Crain, of Castroville, Cal. This invention relates to that part of a grain separator which effects the first separation of the straw from the grain before the delivery of the grain and chaff to the shaking shoe. The separator has two screens arranged in the same plane at a distance from each other, and combined with suspending arms and a rake for continuing the passage of the straw from one to the other, and a reversely-geared pitman for giving opposite oscillatory movements to the screens.

An improved harrow has been patented by Mr. Sven Anderson, of Humboldt, Neb. This invention consists of improved contrivances for extending and contracting a V-shaped harrow, to widen and narrow it to suit different conditions and kinds of plants to be cultivated. The handles are crooked, and they are detachably connected to the bars by clips, enabling them to be taken out and shifted from side to side to range in proper relations to the attendant, whether the harrow be contracted or extended, and the clips are fitted to shift up and down on their pivot, and be fastened by the bolt to alter the pitch of the handles to suit the attendant.

### MISCELLANEOUS INVENTIONS.

Mr. Lorenzo D. Hurd, of Candor, N. Y., is the patentee of an improved running gear for wagons. The object of this invention is to provide mechanisms for locking and releasing the axles, fifth wheels, and tongues of wagons, and also for regulating the gather of the forward wheels.

Mr. William W. Wythe, of Red Bank, N. J., has added to his list of patents recently obtained an improvement upon clutch pulleys. This mechanism is to be used with pulleys with hoisting drums for engaging and disengaging a prime mover, and at the same time holding the object being raised at any elevation desired.

Messrs. F. C. Smith and John W. Weitzell, of Atlanta, Ga., have obtained a patent for an improvement in the side springs of vehicles, the object of the invention being to give greater strength to the spring gear and to prevent the lateral swinging motion of the wagon body.

An improved fruit basket in which the cover is made integral with the basket has been patented by Messrs. John W. Rockafellow, of Stockton, and P. T. B. Nevius, of Flemington, N. J. The invention consists in a basket made of splints projecting above the top ring, and adapted to be folded over the top of the basket and to form the cover.

Mr. Julius Stommel, of Washington, D.C., has invented a foundation for a pavement, consisting of a number of single cells made in the form of iron boxes or tubes, having interlocking parts, substantially as shown and described, whereby any desired curvature may be given to the foundation, and the latter may settle uniformly after the superstructure is placed upon it.

A composition to be applied to roofs and walls for rendering them water and fire proof has been patented by Mr. R. J. Pattison, of New York city. This compound consists of mineral wool, plaster of Paris, oil, liquid glue, all thoroughly mixed together and moulded, after which it is subjected to a heat of from 100° to 160° Fahr.

Mr. William S. Mallard, of Darien, Ga., has patented an improved rice field trunk and gate, consisting of a trunk having an upright water receiving chamber, communicating with a passage through the trunk, and the gate fitted in and adapted to be moved vertically in the chamber, and having a hinged part adapted to open a passage through the trunk when the gate is down.

A novel attachment to the treadle of a sewing machine for aiding and facilitating the operation of the treadle has been patented by Mr. J. A. Robison, of New Washington, Ind. A weight is secured to the treadle above the treadle shaft, and a spring is attached to the weight and frame, both of which serve to aid in depressing the toe of the treadle.

Mr. William Wilmington, of Toledo, O., has patented an improvement in car wheel chills of that class which have in the outer portion of the flange face a peripheral receptacle for the reception of sand, or its equivalent, the purpose of which is to retard the cooling of the molten iron composing the outer portion of the flange to increase the depth of the chilled iron in the concave part of the tread and flange of the wheel.

An improved fire escape ladder has been patented by Messrs. Handley B. Kimball and Cornelius S. Barrett, of Charlotte, Mich. This ladder consists of [illegible] and provided at the joints with shoulders, so that the bars will assume a zigzag shape, and the rounds of the ladder will be held away from contact with the side of the house, and descent on the ladder thereby very greatly facilitated.

Mr. F. W. Codding, of Barre, Mass., has patented a device for tightening automatically the belts of machines. A ring or ferrule is slipped over the double end of the belt before the latter is passed over the driving wheel of the machine, and in this way all slack is taken up and the driving wheel is operated to the best advantage, there being no loss of power by the slipping of the belt.

Messrs. J. S. Pardee and Albert Morley, of New Troy, Mich., have obtained a patent for a nut lock for bolts which is an improvement upon a patent granted to Mr. Morley, in May, 1872, and the invention consists in making the locking key slightly eccentric, so that when it is turned it will have a binding action upon the nut, and will take up any play there may between the nut and the bolt.

A patent has been granted to Mr. William C. Seaton, of Quebec, Canada, for an improved wick trimmer, and the invention consists in a wick trimmer consisting of a box containing a removable box in which a revolving brush is journaled, which wick trimmer is provided with single and parallel slots and recesses, to adapt the device to be used for cleaning and trimming single, double, and circular wicks.

An improved insole has recently been patented which consists of a pair of outer sheets of perforated material, with a woolen sheet between them. This renders the insole a non-conductor, and permits the perspiration to escape at the same time. The insoles are provided at the heel and toe with roughened plates which hold them in place and prevent them from slipping. Mr. Oliver Long, of Brooklyn, N. Y., is the patentee of this invention.

An improved hame tug has been patented by Mr. William Fawcett, of New York city. The draught arm of the hame is provided with an outwardly projecting hook to receive the eye of the hame tug, and with a suitable device for securing the same in place, the object of the invention being to enable the ready attachment and detachment of the hame tugs from the hames, and so that the former may be made separately from the latter.

Mr. F. D. Hill, of New York city, has patented an improved burglar alarm which is constructed with a spring clamp connected with a bar jointed to a suspended frame carrying a clock work and gong, and a sliding rod provided with a spring, and having hangers to engage with the escapement anchor, and a catch attached to the suspending bar, whereby the alarm can be readily suspended from a door knob, and will be sprung by the movement of the knob.

An improvement in chronometer escapements has been patented by Mr. August W. Kientoff, of Dallas, Oregon. In this improvement a lever is provided in connection with the balance wheel so as to be oscillated by it, striking at the same time a second lever, which thereupon unlocks the escapement wheel, this lever being thrown forward immediately by a spring to lock the escapement wheel after it has moved the distance of one tooth. The invention relates also to other details of arrangement and construction.

A very simple type writing ruler has been patented by Mr. Henry B. Mead, of Stonington, Conn. This type writing ruler is very inexpensive and simple and may be used for printing addresses, show cards, etc., where stenciling or other methods are less desirable. This ruler has a bed plate and guide holes for securing the paper firmly while being marked. The ruler is provided with graduated marks which correspond to the spaces occupied by the type.

An improved hand truck has been patented by Mr. William P. Brown, of Zanesville, O. This truck is provided with hooks which pass over the top of the object to be handled, serving to retain it firmly on the platform of the truck, and also to assist in loading it on the same. A bail is provided also which may be passed over the top of barrels or sacks for holding it in place. The truck further may have two sets of wheels, one back of the other, to facilitate the passage of the trucks over obstructions.

Mr. Johiel Jackson, of Fort Atkinson, Wis., has obtained a patent for an improved buckboard. The spring boards, instead of extending continuously from one axle to the other, are made much shorter than in the common buckboard, and meet in the middle, where the body or box of the wagon rests on the springs and are there held together, and so as to support the box by suitable arch boards and bolts. This construction relieves the wagon of much of the disagreeable jarring or shaking common to the ordinary buckboard.

Mr. Fletcher Joyner, of Glens Falls, N. Y., is the patentee of an improved center board for sailing vessels. This invention consists of an improved arrangement of contrivances for raising and lowering the center board, and for holding it up in the trunk of the vessel in such position that when the vessel heels over by the force of the wind, the center board will maintain a position perpendicular to the surface of the water, and thus have better power to keep the head of the vessel up to the wind than when the common center board is used, which inclines with the motion of the vessel.

An improved device has recently been patented for ascertaining the flow of electrical current in a circuit and for recording such flow. This device is called an electrical meter, is specially applicable for indicating the current in a system for running incandescent electric lamps. An electro magnet will be employed in conjunction with a recording mechanism, and the number of revolutions made by the motor will be exactly proportioned to the flow of current. The inventor of this device is Mr. Edward Weston, of Newark, N. J., and the patent has been assigned to the United States Electric Lighting Company, N. Y.

A gymnastic chair has been recently patented which consists in a rocker provided with two side supports carrying crutches at their upper ends to be placed under the arm of the occupant of the chair. These arms are arranged to slide up and down in suitable tubes, so that they may be raised to any desirable height, and this tube is arranged to swing longitudinally or laterally, being mounted upon a universal joint. This chair may be found of service to support aged or weak persons, or it may be found convenient for use on shipboard. The inventor of this device is Mr. W. E. Kelly, of Rockville, Pa.

Mr. William M. Brock, of Shamokin, Pa., has patented an improved telephone annunciator, switch board, and transfer table for facilitating connecting two telephone subscribers with each other in such a manner that they do not interfere with the other lines, and are not disturbed themselves. This switch board is divided into a series of annunciator plates, each provided with a like number of plugs, combined with as many wires or rods as there are plugs in each annunciator section, which wires or rods are attached to the back of the switch in such a manner that the like plugs of each annunciator section can come in contact with the same wire or rod.

Mr. John W. Resor, of Jem, Mo., has patented an improved chimney sweeper, consisting of a frame carrying brushes around the edges and suspended on an endless chain in the chimney, and capable of being moved up or down in the chimney by the chain. It will be seen that the chimney is only obstructed by the chain itself, as the brush will be shifted down below the smoke inlet to the chimney when it is not in use, and the slight obstruction of the chain will be much less than soot would obstruct if the brush were not employed. The splints of the brush are preferably made of thin, flat steel, but may be round if desired, and brass or tough iron may be used.

An automatic car scale for weihging the car body and its contents, and designed to be attached permanently to the car, has been patented by Mr. Chas. Lederer, of Norfolk, Neb. The body of the car is supported on the trucks by springs, which latter are depressed proportionately to the superimposed weight. A registering apparatus is placed underneath the car, and this is connected with a bracket over the springs by means of suitable rods and belt crank levers, and as these brackets at both ends of the car are depressed by the weight on the springs, the two rods connecting the bell crank levers and the register will be receded and the weight of the load thereby indicated on the scale.

A very simple automatic telegraph has recently been patented by Mr. James W. Rogers, of New York city. The apparatus consists in a cylinder having a spirally-grooved periphery and a jacket having characters indented therein below the normal plane of the jacket, and two terminals of an electric circuit arranged upon the indented side of the jacket, one of which is made movable and traverses the route of the indentation, being thrown into contact with the other terminal by the non-indented portion or normal plane of the paper. With this apparatus, when a message has once been transmitted on the paper in the form of indentations in the Morse character, the message may be immediately retransmitted without the necessity of removing the paper from the cylinder upon which the message was first recorded.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) F. H. R. writes: I have a cylinder 3½ inches diameter and 4½ inches stroke, with ports ¼, ⅝ by 1⅝ inch. Would a ½ inch pipe for steam supply and a ¾ inch pipe for exhaust be too small or not? A. Too small. Make your steam pipe not less than ¾ inch and exhaust pipe 1⅛ inches diameter.

(2) A. T. asks if any process has yet been discovered for the preservation of timber from dry rot, and the teredo navalis, cheaper than or as effectual as the injection of creosote. A. The universal opinion seems to be that creosoting is the cheapest and most effective process in use. The method referred to by our correspondent is probably the kiln dried wood.

(3) T. G. K. asks: If a car be traveling at a high rate of speed and a gun be shot off at right angles to the train, will the shot go straight as if the car were at rest, or will it be carried forward? A. The motion of the train will carry it ahead.

(4) S. P. M. writes: I have 1 horse power engine. How can I lay up power from same sufficient to run a sewing machine three or four hours? A. By winding up a weight, that will drive your machine when running down. 2. Will a chest or closet be moth proof if lined with a veneer of red cedar, instead of being made entirely of that wood? A. The veneer does not answer as well as solid wood. 3. Where can I find directions for making a gasoline gas machine for house lighting? A. You will find a description of the "Springfield Gas Machine" in "Appleton's Dictionary of Applied Mechanics." 4. Would a mercury flask boiler, as described in SUPPLEMENT, run a 2½x4 inch engine 300 revolutions a minute (equal to say 1 horse power)? If not, how could capacity of boiler be best increased? A. You should have 7 or 8 flasks exposed to the fire; for one horse power see SUPPLEMENT No. 182.

(5) P. H. S., Jr.—Yeast cakes are prepared by stirring up beer yeast with cold water to which a small quantity of ammonium carbonate has been added. It is then allowed to settle, drained, washed, and pressed into cakes, to which is added a little starch and ground malt. Some kinds of yeast settle with difficulty. In such cases the cold water in larger quantity may be employed, or a little alum may be added to the first water, but it must be completely removed by washing. Instead of starch, flour and Indian meal are sometimes used.

(6) W. T. V. writes: 1. I have constructed a gauge for measuring gas pressure by attaching to a U-shaped glass tube a scale laid off in inches and tenths of an inch, numbering the degrees both upward and downward from a center or zero line, and filling the tube to this line with water. Is the gauge correctly made, and will the diameter of the tube make any difference? A. Your gauge is correctly made. The diameter makes no difference. The difference in the two levels is the measure of the pressure. 2. When the liquid rises one inch in one side of gauge and falls one inch in the other, does it indicate what is known as one inch pressure? A. Indicates 2 inch pressure. 3. Is the pressure in street mains greatest at the highest points, and if so, what is the rate of increase per foot in height? A. The pressure is slightly greater at the high points. The increase is one-tenth to one-fifth of an inch water pressure in a hundred feet according to the density of the gas.

(7) E. C. P. asks: 1. What horse power will a stream of water filling a three inch pipe under a fall of 100 feet furnish? What for a 4 inch pipe? What will 50 feet fall be, conditions as above? A. For 3 inch pipe 100 feet fall, 20 to 29 horse power, depending upon friction and length of pipe; and 4 inch pipe, 47 to 50 horse power; 3 inch pipe, 50 feet fall, 18 to 20 horse power, and 4 inch pipe, 33 to 35 horse power. 2. What kind of wheel or other contrivance would you recommend? A. We recommend a turbine.

(8) W. M. R. asks: Will you be kind enough to answer me the following: 1. Why is platinum not used for the conductor, instead of carbon, in incandescing lamps? A. Because the platinum is volatilized and is soon destroyed, and because a slight increase in heat over that required to produce incandescence melts the metal. Carbon is more refractory. 2. Is there a SUPPLEMENT that gives a full treatise on the subject of "Electric Lighting"? If not, would you give me the name of a book? A. Electric lamps, SUPPLEMENT, No. 162. Brush system of electric lighting, SUPPLEMENT, No. 274. Illumination by electricity, SUPPLEMENT, No. 132. Lighting by electricity, SUPPLEMENTS, No. 78, 98, 99, 103. 3. I see that Edison has formed a company for his electric railroad, and as I understand it, Marcel Deprez's experiments on conducting electricity long distances show a loss in so doing of at least 50 per cent in the transmission. If that is so, how can Edison operate a railroad long distances, practicably or profitably? A. Edison uses a very large conductor—the rail—consequently the loss is small.

(9) F. A. R. asks: What is the best paint to use on a tin roof, the water (filtered) from which is used for drinking and cooking purposes? A. For painting your tin roof use the red oxide of iron; it is sold among the dealers as "Prince's Metallic Paint." It is a dry red powder. Mix with boiled linseed oil to the proper consistence for the brush. Use no turpentine.

(10) G. L. Asks: 1. Is the motion produced by an eccentric uniform throughout the stroke, or is it slow at both ends, as some claim? Is the motion produced by a crank the same as that produced by an eccentric? A. Precisely like a crank—slow at both ends. 2. In what essential particulars is the Corliss type of engine superior to the common slide valve engine? A. Principally in fixing the rate of expansion in accordance with the actual work on the engine from hour to hour and minute to minute.

(11) C. A. W. asks what superiority flat and V-friction hoists have over gearing. A. We do not know that friction gear has any advantage over toothed gear for any purpose, except the single one of throwing out and into gear while running, which can be done properly with friction gear, but cannot be safely done with tooth gear.

(12) J. S. H. writes: I intend to make a glass speculum according to directions given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 141. How long a focus should a ten inch reflector have, and would a plane mirror do for the small reflector? A. 10 feet focus is a good proportion. A plane metallic mirror or prism for small reflector for Newtonian form. A silver faced small reflector made in the same way as the large one might answer.

(13) J. R. M. asks: 1. Is there any danger of burning the bottom of a fire box boiler when the grate bars burn down? A. We do not quite understand your first question, unless you mean to ask whether a fire that will burn grate bars under a boiler will not be likely to burn the boiler? In this case no harm can be done to the boiler if there is plenty of water in it. Grate bars have been heated so hot as to fall, without injury to the boiler. It shows a bad method of firing, such as making a deep fire and closing the ash pit tight. 2. What size steam pipe should we have to carry steam 12 feet from the boiler, to supply a cylinder 10x12 running 150 revolutions per minute? A. 2 inch steam pipe.

(14) In response to numerous inquiries concerning good non-conducting covering for steam pipes, we give following tests of Mr. G. B. Dumford of Hamilton, Ont. These may be found superior in some cases to tests of Mr. C. E. Emery (SCIENTIFIC AMERICAN July 7).

| | |
|---|---|
| Combination of asbestos, hair felt, air space, and wood | 100 per cent |
| Asbestos and hair felt and chopped straw (the straw mixed with lime putty) | 87 " |
| A plastic cement manufactured by parties at Troy N. Y., with ½ inch hair felt outside | 86·6 " |
| Paper pulp mixed with lime putty 1 inch covered with sheeting of wood pulp | 85 " |
| Mineral wool cased with wood | 81 " |
| " " cased with sheet iron | 79 " |
| Charcoal | 60 " |
| Sawdust | 41 " |
| Loam and chopped straw sealed with wood | 32 " |
| Asbestos | 29 " |
| Coal ashes | 24 " |
| Air space | 20 " |
| Fire brick | 15 " |
| Red brick | 12 " |
| Sand | 9·3 " |

(15) A. L. McL. asks for the best method of cleaning bright iron and brass of an engine badly injured by exposure to water during late flood. A. Use flour emery cloth and oil for the bright iron and oil and tripoli or oil and rotten stone. If the brass is badly corroded, use oxalic acid and tripoli.

(16) O. E. G. asks how to clean brass. A. Make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar, having also ready a pail of fresh water and a box of sawdust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with sawdust. This immediately changes them to a brilliant color. If the brass has become greasy, it is first dipped in a strong solution of potash and soda in warm water; this cuts the grease, so that the acid has free power to act.

(17) O. C.—To make court plaster, take French isinglass, 1 ounce; warm water, 1 pint; glycerine, 1 ounce; tincture of arnica, half an ounce. Soak isinglass in a little warm water for twenty-four hours, then evaporate nearly all the water by gentle heat. Dissolve the residue in a little proof spirits of wine and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Stitch a piece of silk or sarsanet on a wooden frame with tacks or thread. Melt the jelly and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry apply over the whole surface two or three coatings of balsam of Peru. This plaster remains quite pliable and never breaks.

## NEW BOOKS AND PUBLICATIONS.

DAS EISERNE JAHRHUNDERT (THE IRON CENTURY). By A. Von Schweiger-Lerchenfeld. Wien, Pesth and Leipzig.

We have received from A. Hartleben parts ii., iii., and iv., of a work entitled the "Iron Century." Each part consists of 32 octavo pages, the whole work to be completed in 25 parts, and to contain 40 full page illustrations, with maps, etc. The work is devoted to the wonderful iron structures of the present century. On the title page is a large cut of an American locomotive, with blazing head light, coming directly toward us. The parts thus far received are devoted chiefly to railways. Pictures are given of the early locomotives of Blenkinsop and Stephenson, and portraits of Stephenson, Trevithick, and other inventors. The work is intended rather for popular reading than for scientific instruction. Among the views published or to come are a front view of St. Pancras station in London, the Tay Bridge, the Rhine Bridge at Kehl, the tunnel at Trieste, the New York Elevated Railroad, the Brooklyn Bridge, the Pennsylvania Railroad depot in Philadelphia, the Great Eastern, the Elbe, the Pereire, the Normandy, an American river steamer, Pacific Railroad, coal mines, etc.

THE AMERICAN PSYCHOLOGICAL JOURNAL, ISSUED BY THE NATIONAL ASSOCIATION FOR THE PROTECTION OF THE INSANE AND THE PREVENTION OF INSANITY. Vol. I., No. 2. P. Blakiston, Son & Co., Philadelphia.

The titles of some of the principal articles will give an idea of the object of this periodical: "The Rights of the Insane." "The Insane at Home." "Legal Control of Insane Asylums." "Employment a Remedy for Insanity." These and other contributions are from the editors and others who have had experience and ample means of observation among the insane.

PAINTING AND PAINTERS' MATERIALS. A Book of Facts for Painters and those who use or deal in Paint Materials. By Charles L. Condit, supervised by Jacob Scheller, Master Painter. *Railroad Gazette*, 73 Broadway, New York. Price, $2.25.

This volume of 465 pages appears to be an almost exhaustive treatise on paints as preservatives and pigments as decorations. The subject of painting is viewed, first, as a scientific fact, involving a knowledge of substances on which painting is employed, and thus incidentally gives, in its consideration, valuable information regarding the characteristics and textures of woods and their proper preparation for the coating of paint or of varnish. The nature of the materials of pigments and of paint bodies, varnishes, driers, and other substances forms a valuable portion of the treatise. Textual instruction in the use of implements and plain directions as guides to drawing add to the interest of the volume. A general index, a copious index of pigments, and a full table of contents embance the value of the volume as a book of reference.

MODERN LOCOMOTIVE ENGINES; THEIR DESIGN, CONSTRUCTION, AND MANAGEMENT. By Emory Edwards, M.E. Illustrated by seventy-eight engravings. Henry Carey Baird & Company, 810 Walnut Street, Philadelphia. Price of volume, $2.00.

The author of this volume has written also several other books on cognate subjects: a "Catechism of the Marine Steam Engine," "Modern American Marine Engines," "Practical Steam Engineer's Guide," and this volume, which has been gotten up as an assistant to the locomotive engineer. He credits the current information conveyed by technical papers and periodicals for assistance. The only serious fault with the book is that it attempts to combine the entire history of steam in a single volume, and unnecessarily gives crude facts of the earlier investigations into natural forces which had been given in the text books, and have since become powers by modern practice. But the volume is full of suggestive and direct information to the beginner, and contains useful lessons even to the experienced engineer. The chapter on the economy of fuel and the succeeding one (Chaps. III. and IV.) are of significant value to the beginner and of suggestive information to the engineer. The chapters on the construction, service, wear, and duty of locomotives commend themselves to the master mechanic, the machinist, and the locomotive engineer. The appendix of tables enhance the value of the volume to steam mechanics and others.

## INDEX OF INVENTIONS

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**AND EACH BEARING THAT DATE.**

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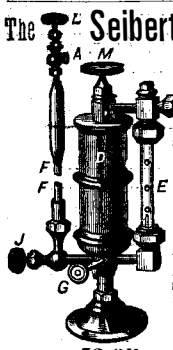


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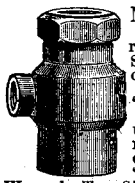

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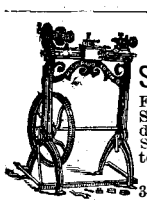

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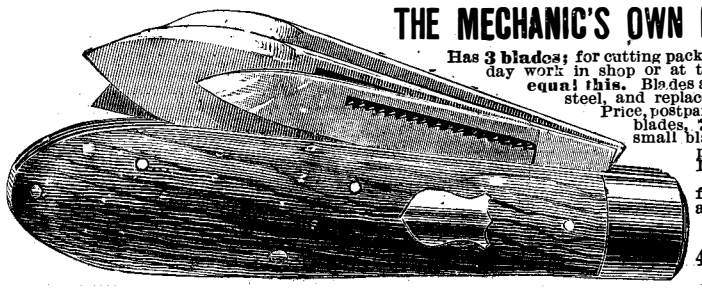

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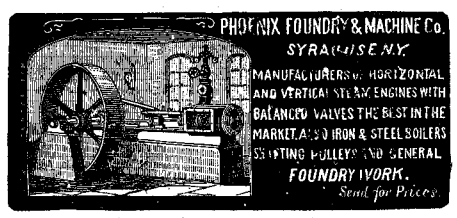
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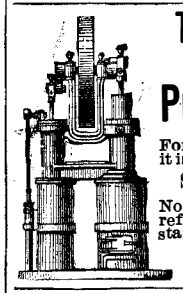

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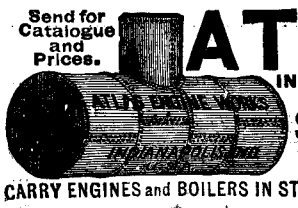


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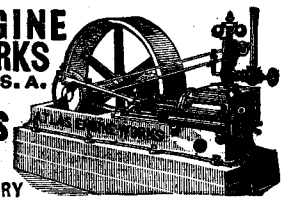

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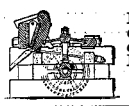

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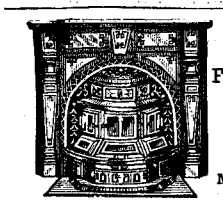

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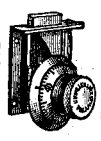

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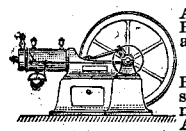

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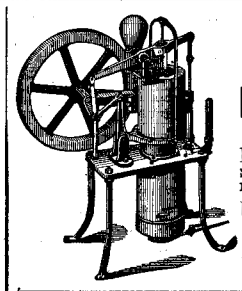

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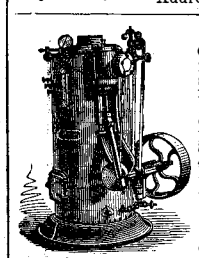

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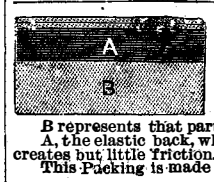


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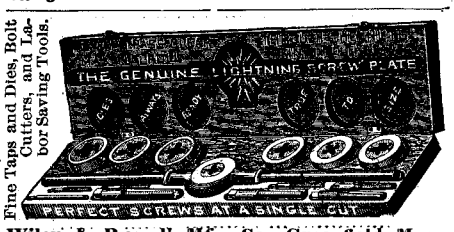


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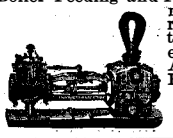

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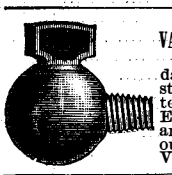

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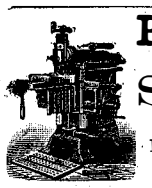

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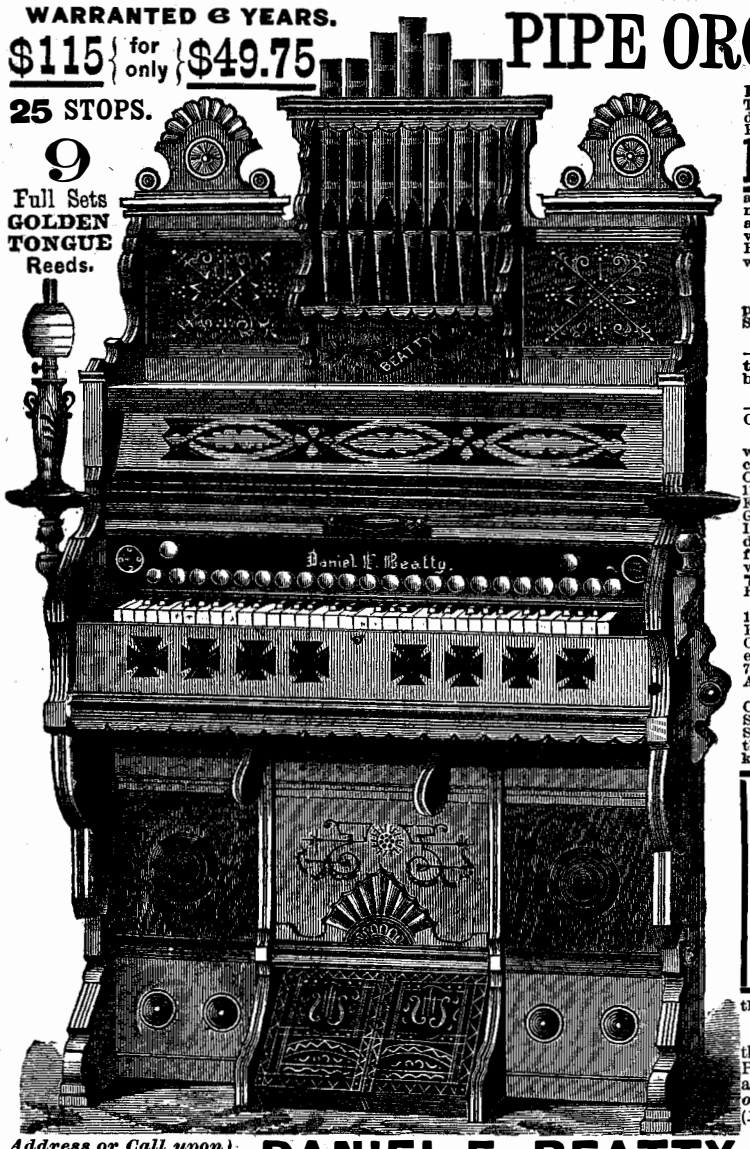


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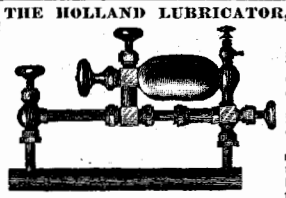

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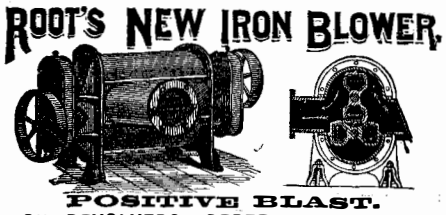

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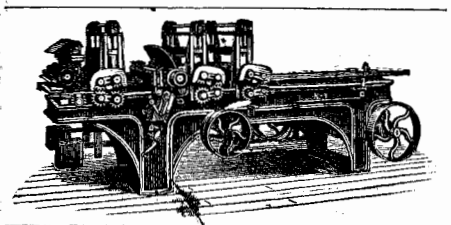

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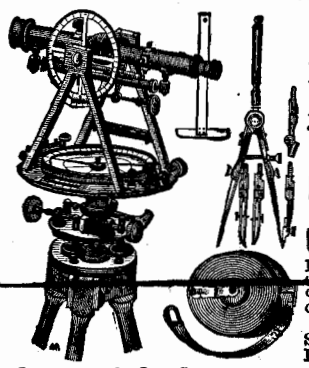

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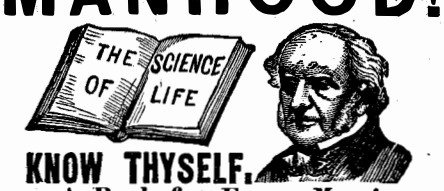


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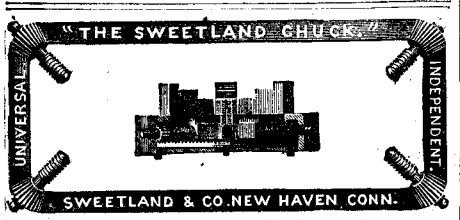


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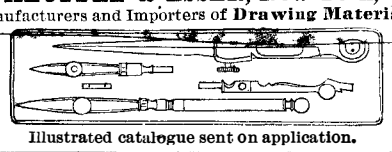

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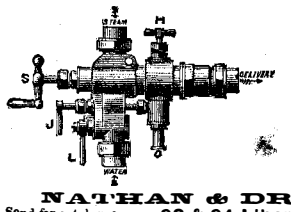

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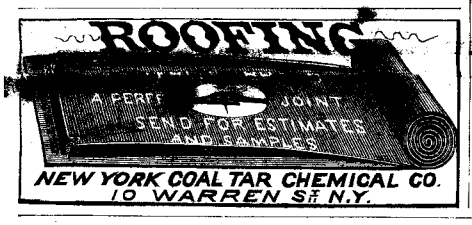


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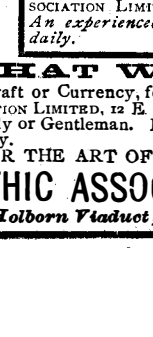

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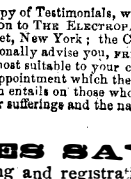


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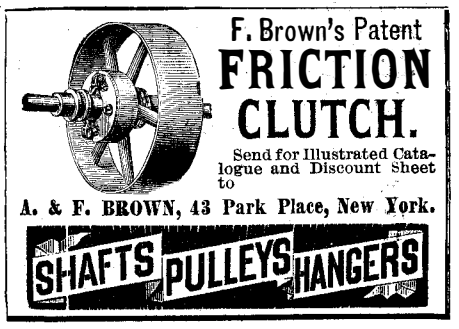


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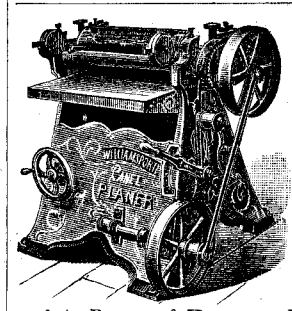

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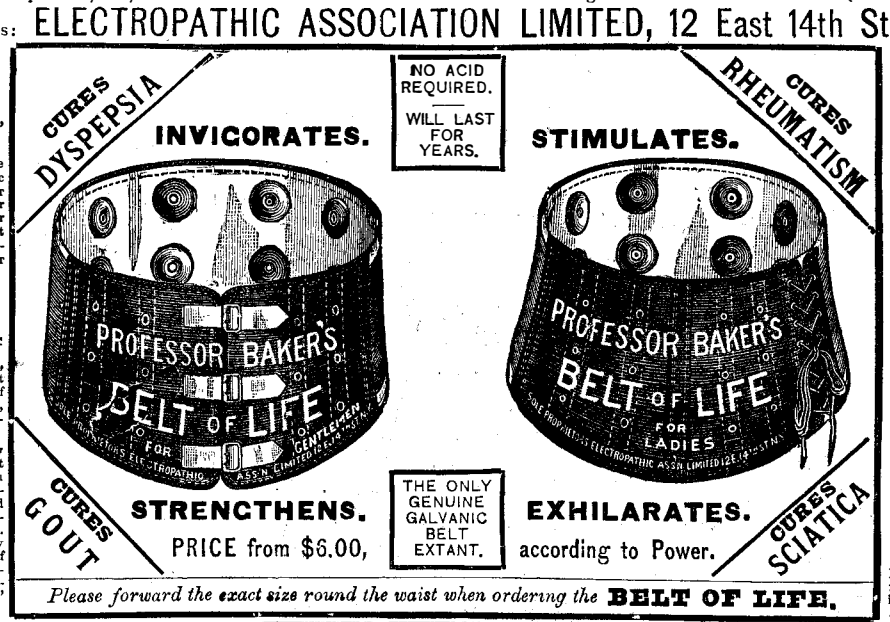


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